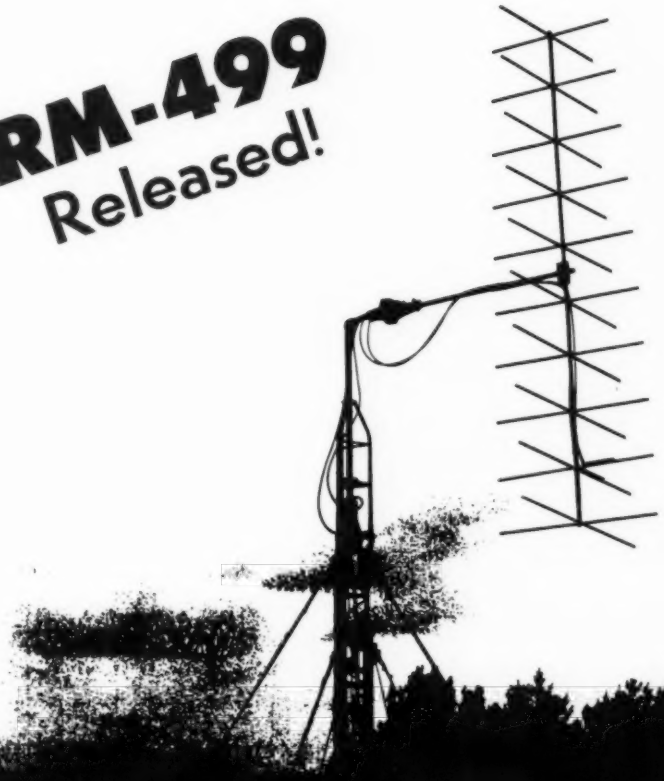
73

Amateur Radio

May 1965
It may be 40c.

RM-499 Released!



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Beer Can Converter 1215'er 5000 Watt Linear!

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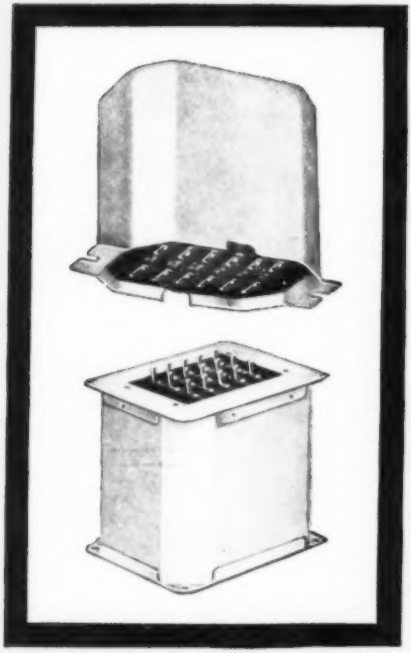

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73

Magazine

Wayne Green W2NSD/1
Editor & Publisher

Paul Franson WA1CCH
Assistant Editor

May, 1965

Vol. XXXI, No. 1

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ADVERTISING RATES

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Roughly, these are our rates. You would do very well, if you are interested in advertising, to get our official rates and all of the details. You'll never get rich selling to hams, but you won't be quite as poor if you advertise in 73.

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Postmasters, please send form 3579 to Good Old 73 Magazine, Peterborough, New Hampshire. You are coming up for our July 4th hamfest, aren't you?

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de W2NSD/1

never say die

They Laughed

Yet, they laughed and sneered when I said, "FCC Docket Due in March." On March 31st the FCC dropped the bomb. I laughed back. Here is the FCC synopsis of the proposal . . . you can read the whole dreary text in QST, if you want, it won't get you anything over this:

FEDERAL COMMUNICATIONS COMMISSION

65821
PUBLIC NOTICE-S
March 31, 1965

WASHINGTON, D. C. 20554
Report No. 1851

NONBROADCAST AND GENERAL ACTION

The Commission en banc, by Commissioners Henry (Chairman), Hyde, Bartley, Lee and Cox took the following action on March 31:

INCENTIVE LICENSING AND DISTINCTIVE CALL SIGNS PROPOSED FOR AMATEUR RADIO SERVICE

The Commission proposed amending the Amateur Radio Service rules to provide a new "Amateur First Class" operator license with reservation of the lower half of the 3.8, 7.2, 14.2 and 21.25 Mc telephony sub-bands, and 50.00-50.25, 144-145 Mc to Extra and First Class operators only. Reservation of the lower 50 kilocycles of the 3.5, 7, 14 and 21 Mc bands for Extra Class telegraphy operation is also proposed. The lower half of each segment would become reserved in 12 months, with full reservation 2 years after adoption of the proposed rules.

The First Class examination would require a 16-word-per-minute code test and a written examination intermediate in level between the General and Extra Class examinations. Eligibility would be limited to applicants who have held an Advanced, General or Conditional Class license for at least a year.

Except for a proposed elimination of Novice telephony privileges in the 145-147 Mc band, all classes of licensees would continue to have telegraphy and telephony operating privileges in a portion of each band in which they now have such privileges. Because a valid distinction between them no longer exists, Advanced Class licenses would be changed to General Class upon any renewal.

A distinctive call sign assignment procedure is proposed. The stations of Extra and First Class licensees would be assigned "two-letter" calls (two letters following the number). Unassigned two-letter calls with a single letter prefix would go to the old timers of these classes who were licensed prior to July 1, 1932. Conditional and Technician licensees would be assigned a distinctive two-letter prefix as has been the case for Novice Class licensees. The "one-by-three" combination would be reserved for the Advanced/General Class group.

This action constitutes the Commission's proposed action on petitions RM-378, 455, 470, 474, 480, 481, 499, 516, 517, 538 and 577.

Comments of interested parties may be filed by July 15 and replies by July 30.

Riot, eh?

When I first read it I was surprised at how closely this proposal follows RM-577, my own entry in the incentive licensing derby. You can go back and research my submission if you like and see the strong parallel, I won't belabor you with it. After looking over all of the ideas brought up on the incentive licensing deal I sorted out those that seemed most practical to me and presented them in a package to the FCC.

The resulting plan, Docket 15928 (they could have given us a lot better number than *that*), successfully answers most of the criticisms leveled against ARRL's RM-499. Most important of all it does not throw anyone off any bands.

My first reaction to 15298 was one of relief . . . it wasn't as bad as it could have been. Then I got thinking about what this was supposed to accomplish . . . and what it might accomplish. Rather than my carrying on at length this month with my views, why don't you talk this one over . . . and even more important . . . think it over and see what you decide about the thing. Carefully consider what value the three wpm code speed increase will have . . . and what drawbacks there are to it. Also consider the pros and cons of the First Class license. Ponder too the impact on ham radio as we know it of the splitting of the bands . . . the new call signs . . . consider each band separately . . . the effect on contests, DXing, rag chewing, six meters, two meters, etc. Will these changes be beneficial enough to be worth the immense cost to the FCC in assigning us all new call signs and stepping up their monitoring program to keep up without further divided up bands, not to mention the one to two million dollars in new license fees we will have to pay . . . the effect on older hams who are leading busy professional lives and may be discouraged at having to learn a new license test all over again to keep in touch with

their old buddies . . . the great problems thousands of us have in merely getting to an FCC licensing point now that the Conditional License is virtually a memory.

Think it all over and send your thoughts in as soon as you can so I can run them in the June issue. I'll try to sort out the most well thought out letters. Letters received here before April 30th will be considered for June and those up to May 30th for our July VHF issue.

Perhaps, in view of the 16 wpm bit, it is time to discuss the value of CW ability today . . . 1965.

July 4th

Ever since our open house back in August 1962 I've been wanting to get more of you up here for a personal visit and to get you to see New Hampshire. The big day is July 4th. If you can manage it please come on up and join us for a New England Hamfest. We're trying to think of everything possible to make this an outstanding time.

Bring any ham gear you want to sell . . . we'll have a big auction going all day long . . . at least as long as the gear holds out. We'll be renting the local armory here so we'll have lots of space for exhibits by manufacturers and dealers. Bring a picnic lunch or plan on snacking at any of the nearby restaurants . . . there is one right across the street from the armory.

We'll be set up for field strength measurements on both 144 mc and 432 mc, so bring the best antenna you can hold by yourself and see if you can win the prize for the best field strength. We will have a real professional setup to test the antennas . . . here's your chance to see how good yours really is.

Since 73 is largely devoted to homebrewing gear we'll have prizes for the best home constructed equipment . . . bring as many entries as you want.

We'll also have tours of the 37 room headquarters building and the 73 Mountain VHF shack. We want you to see as much of New Hampshire as possible too so we'll have special maps available which show the major places of interest in the state. And, as I may have mentioned before, New Hampshire is one of the most beautiful states in the union . . . and it is small enough so you can easily drive over much of it in one day. If you drive up from New York, New Jersey, Pennsylvania, etc., on Saturday you will be able to visit lower New Hampshire that same day. Sunday is our hamfest. On Monday (a holiday) you can go up through the White Mountains, up the Tramway, the Flume, and Mt. Washington, and back home again that night or the next morning. We're only a little over four hours by car from New York City here.

If you think you are coming you might drop us a card and let us know so we can plan things for the size group we'll have. Also, if you will be wanting reservations to stay overnight in the area we can help with that too . . . but please don't wait too long for New Hampshire is buzzing at this time of year and reservations can be hard to come by.

If you have mobile VHF gear you can give it a good workout from nearby Pack Monadnock . . . you can drive right to the top. Mt. Monadnock (73 Mountain) is available for easy climbing if you dig that stuff.

Do figure on coming up for a hello and a good time on the 4th.

Hamfest?

Paul and I took in the IEEE show and SSB Hamfest this year. Though I was disappointed that they made room for CQ to have a booth, while having no room for 73 . . . it was all for the good. CQ did a rousing business in engraved badges and I got to talk to about 1000 friends. Peggy Browning was there, fresh from her visit to Bhutan. Dannals was there, but didn't notice me. Huntoon waved hello. A couple of the manufacturers who have been pointedly not advertising in 73 smiled cryptically. And quite a few fellows bent my ear, filling me in on recent ARRL misdemeanors and other trivia of ham life.

We also took the opportunity to stuff on interesting foods: Japanese, Chinese, Lebonese, and Viennese. Say, if you are ever looking for one of the nicest, friendliest restaurants in New York, you might visit the Konditorei, 33 Irving Place . . . regards from Wayne. Stop in for some coffee and Viennese pastry some night, at least.

Ham Stamp Wins Award

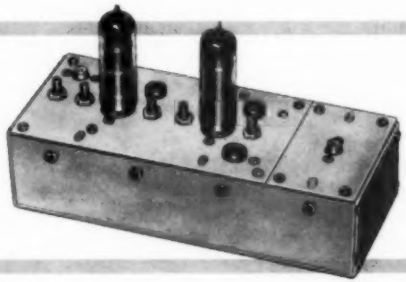
"Sour Grapes," they said . . . accusing me of being critical of the ham stamp just because it was designed by the ARRL. Well 30,249 votes were counted in the 17th Annual Design Derby for the best and worst design of U. S. commemorative stamps. Of the 18 different commemoratives issued in 1964 our blessed ham stamp got the fewest votes for "Best Design." Not content with giving us the booby prize, the poll also asked for votes for the worst design of the year. We only won second prize in that category . . . being displaced by the Fine Arts stamp. Perhaps we

Continued on p. 100

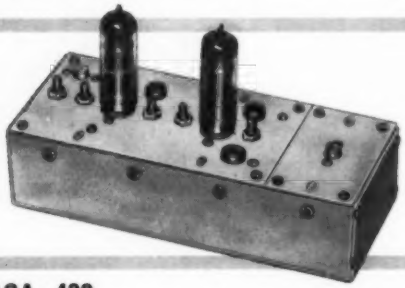
NEW FROM

VHF/UHF UNITIZED TRANSMITTERS
50 mc — 420 mc

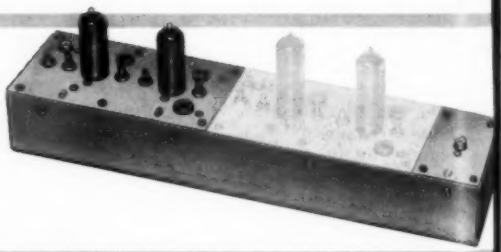
AOD - 57
DRIVER/TRANSMITTER FOR 50 OR 70 mc
The AOD-57 completely wired with one 6360 tube, two 12BY7 tubes and crystal (specify frequency). Heater power: 6.3 volts @ 1.2 amps. Plate power: 250 vdc @ 50 ma.
AOD-57 complete **$69.50**



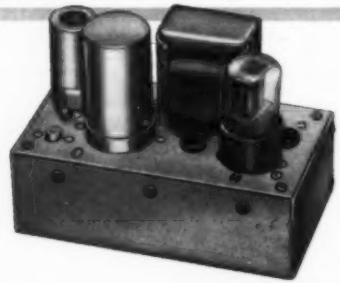
AOA - 144
MULTIPLIER / AMPLIFIER FOR 144 mc
The AOA-144 uses two 6360 tubes providing 6 to 10 watts output. Requires AOD-57 for driver. Heater power: 6.3 volts @ 1.64 amps. Plate power: 250 vdc @ 180 ma.
AOA-144 complete **$39.50**



AOA - 220
MULTIPLIER / AMPLIFIER FOR 220 mc
The AOA multiplier / amplifier uses two 6360 tubes providing 6 to 8 watts output on 220 mc. Requires AOD-57 for driver. Heater power: 6.3 volts @ 1.64 amps. Plate: 250 vdc @ 150 ma.
AOA-220 complete **$39.50**



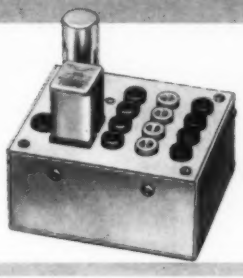
AOA - 420
MULTIPLIER / AMPLIFIER FOR 420 mc
The AOA-420 multiplier / amplifier uses two 6939 tubes providing 4 to 8 watts output on 420 mc. Requires AOA-57 plus AOA-144 for drive. Heater: 6.3 volts @ 1.2 amps. Plate: 220 vdc @ 130 ma.
AOA-420 complete **$69.50**



AMD - 10 MODULATOR:
The AMD-10 modulator is designed as a companion unit to the AOA series of transmitters. Uses 6AN8 speech amplifier and driver, 1635 modulator. Output: 10 watts. Input: crystal microphone (High Impedance). Requires 300 vdc 20 ma, no signal, 70 ma peak: 6.3 vac @ 1.05 amps.
AMD-10 Modulator complete **$24.50**

INTERNATIONAL

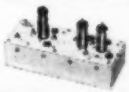
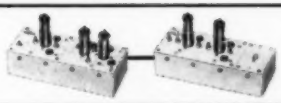
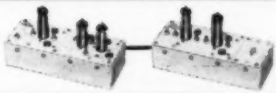
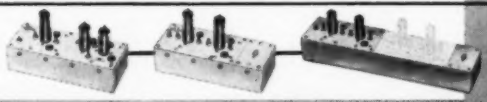
International's new unitized VHF/UHF transmitters make it extremely easy to get on the air in the 50-420 mc range with a solid signal. Start with the basic 50 or 70 mc driver. For higher frequencies add a multiplier-amplifier. All units are completely wired. Plug-in cables are used to interconnect the driver and amplifier.



ARY-4
RELAY BOX
Four circuit double throw. Includes coil rectifier for 6.3 vac operation.
ARY-4 Relay Box complete $12.50

APD-610
FILAMENT SUPPLY
The APD-610 provides 6.3 vac @ 10 amperes.
APD-610 complete $9.50

COMPLETE TRANSMITTER

6 METERS	50 mc	AOD-57	
2 METERS	144 mc	AOD-57 PLUS AOA-144	
	220 mc	AOD-57 PLUS AOA-220	
	420 mc	AOD-57 PLUS AOA-144 PLUS AOA-420	

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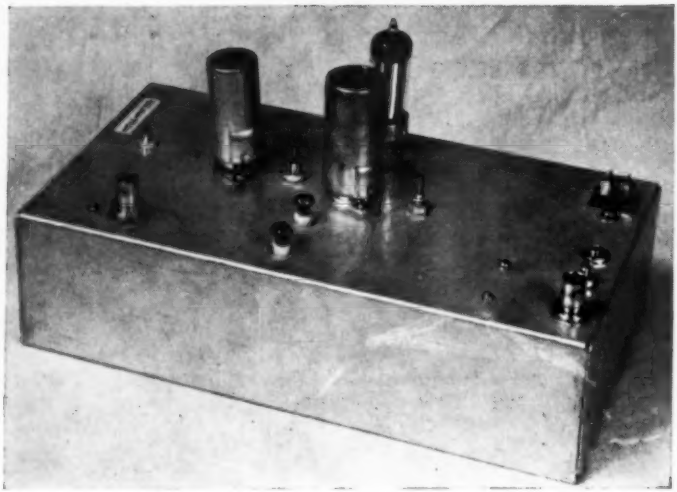


Jim Kennedy K6MO
2816 E. Norwich
Fresno, California

432 mc Converter

The recent increase in interest in 432 mc has sent many a budding UHF enthusiast scurrying to the various handbooks in search of a good converter circuit.

A number of such circuits will be found. However most suffer from circuit complexity. Tube mixers are expensive if they are to be effective. Multiplier chains are often long and somewhat ungainly. In addition, when you have finally built your basic converter, you will still have to add a hot RF preamp to get the most from your receiving system. All these factors can cause even the most enthusiastic ham to pause and count his pennies.

One approach to the problem would be to assume that the converter will be used with a good preamp, at least for long haul work. This will give a much greater latitude to the design of the basic converter.

Noise figure is, within limits, of little importance. In fact, in the interest of economy, no special effort should be made to make the noise figure any lower than that maximum value which the preamp has sufficient gain to cover comfortably. There is no point in paying out good money and time to build an 8 db converter if you intend to put a 5.5 db preamp with 15 db plus gain in front of it. At the same time there is not too much point in building a 8 db converter and no preamp, when a 5.5 db or better preamp can be had for about the same extra cost.

This relaxation of the noise figure requirement makes an inexpensive crystal mixer look very attractive.

The injection chain can be simplified by starting off with an overtone crystal in the 40 mc region. This is a fairly common practice in VHF converters. A crystal in the 60 mc region would eliminate an additional stage of multiplication and reduce the tube compliment by one, but the crystals in this region are more expensive and the frequency stability of the converter may suffer.

The number of tube stages can be further reduced by making use of a simple diode multiplier for the final multiplication.

This leaves three tube multiplier stages required. They can easily be accommodated in two tube envelopes.

The choice of *if* frequency often depends on the receiving frequencies available, but in the interests of image response an rf to *if* ratio of about 10 to 1 is recommended. This makes 6 meters a logical choice.

Using 6 meters as an *if* has an added div-

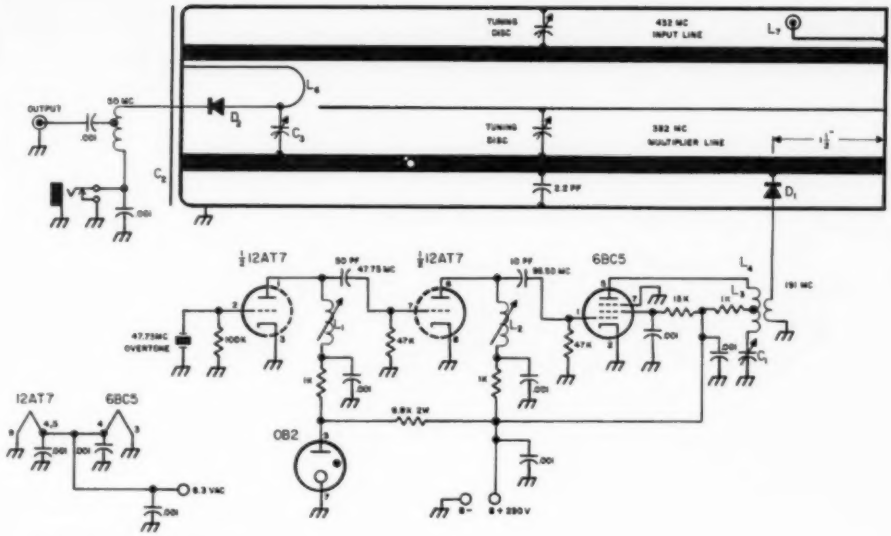


Fig. 1. 432 mc converter.

C1. 1-5 pf plastic trimmer.
C2. UHF bypass. See text.
C3. Injection coupling. See text.
L1, L2. Slug tuned to frequency.
L3. 10 turns #19 enameled ¼ in. dia., CT.
L4. 3 turns #18 enameled, ¼ in. dia.
L5. Slug tuned to *if* frequency. Tapped fairly high.
L6. Mixer coupling. 2½ in. total length, ¼ in. wide.
L7. Input coupling. 1½ in. total length, ¼ in. wide.
D1. 1N72 or 1N82.
D2. 1N21C.

idend. Most 6 meter converters are equipped with a high gain low noise rf amplifier. This abundance of gain will make the *if* amplifier used in conjunction with most diode mixers quite unnecessary. In most cases this eliminates another stage from the 432 mc converter.

Construction

The diode mixer and multiplier circuits are two adjacent trough lines. The multiplier line had to be lengthened somewhat by additional capacitive loading to fit the chassis size used. The lines were made from 16 gauge brass sheet stock and ¾ inch brass tubing. The various coupling loops are made of strips of .003 inch brass shim stock about ¾ inch wide. The various dimensions of the lines are given in Figs. 1 and 2.

Both lines are tuned with variable capacitors constructed of brass discs about ⅝ inches in diameter. The discs are soldered to the inside center of each line. The other capacitor discs are soldered to the ends of 10-32 screws which are mounted through tapped holes in the trough box or by a 10-32 nut soldered to the box.

The mixer diode is mounted on a ¾ inch by 1¾ inch plate of brass shim stock. A hole is drilled in the center of the stock to just clear the ceramic and brass portion of the diode body (but not the brass lip on the large end). Then a 3/16 inch piece of 9/32 inch diameter brass tubing is soldered over the hole. The end of the tubing can be deformed slightly or you may cut slots in it to form fingers which will hold the diode firmly in place.

The mounting plate for the crystal is insulated from the line box for dc by a thin sheet of teflon or mylar tape. This is held in place by two nylon screws or insulated metal screws. This assembly acts as a bypass capacitor for the UHF signals but acts as part of the tuned circuit for the 50 mc signal and has no ill effect on it.

The clip for the small end of the crystal is made by bending the end of the ¾ inch wide diode coupling loop into a triangular shape with a pair of pliers. The small tip on the diode then fits into the clip.

The injection coupling capacitor is a shim stock tab attached to the multiplier line and

Bottom view. Note that input loop is obscured by inner conductor.

brought near the mixer diode loop. Varying the spacing between the tab and the loop will vary the injection coupling.

I have found it convenient when working with such circuits to build the trough lines as a complete sub-assembly, that is, with BNC fittings and other protrusions attached to the trough directly rather than to the trough *through* the chassis. The chassis holes are then drilled out to pass the entire fitting. In this way, the entire unit may be assembled and tested free of the confines of the chassis itself.

Parts layout for the injection chain is not too critical, though it would be well to remember that frequencies up to about 200 mc are involved. Bypass capacitors should be used liberally on B+ and filament circuits. A symmetrical layout which will end with the multiplier diode near the appropriate point on the trough line should be used.

Some experiments were performed in an effort to see if the diode could provide enough mixer drive quadrupling rather than doubling. This would eliminate the need for the last tube multiplier. It was found that the diodes used would provide only enough mixer current to provide marginal operation of the converter, even with the 12AT7 going full blast on 250 vdc.

On the other hand, the circuit should in Fig. 1, which uses the additional tube multiplier, develops more than sufficient drive even at low supply voltages (over 900 microamps with 90 vdc).

As a result, this configuration seems most adequate. If a more exotic diode had been used in the multiplier, the quadrupling arrangement could probably be made to work out. A varactor like the DR-303 would undoubtedly outperform the 1N82's and 1N72's in such a configuration.

The use of the VR tube on the oscillator is not mandatory, but it is highly recommended to maintain the stability of the converter when confronted by line voltage variations. Mounting the crystal below the chassis also improves the stability by protecting the crystal from drafts and other such sudden temperature changes.

Tune up

Preliminary peaking of injection chain can be easily accomplished with an absorbtion meter. An alternate method would be to tune for maximum multiplier diode current. Remember that it is sometimes possible to burn out 1N72's and 1N82's with the rf available from the injection string if they are coupled too tightly.

Once the tube stages are peaked, couple the diode multiplier line output tightly into the mixer diode. The mixer diode current should then be peaked by tuning the diode multiplier line. It should be possible to obtain up to 2 ma of mixer current depending on mixer coupling and diode multiplier input coupling.

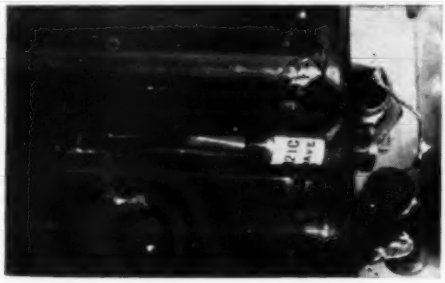
Some care should be exercised in the choice of meter used in measuring mixer current.

Many of the VOM's on the market today employ a 500 ua or less basic meter. It will be found that, in most cases, the internal resistance of such meters is rather high. If this is so, it will produce some very confusing readings when used to measure the diode current. The impedance of the 1N21 series diodes is in the general neighborhood of 300 ohms. If the meter has, for instance, an internal resistance of 300 ohms, then the measured current will be only one half the true current when the meter is removed, because the meter and diode are in series.

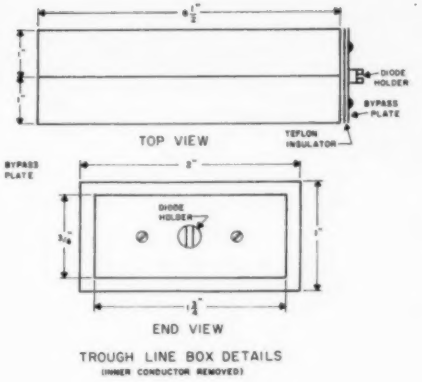
Rather than use the VOM, a better choice would be to use a low internal resistance 0-1 MA meter. Many such meters with internal resistances of about 50 ohms, are available on the surplus market for reasonable prices.

In normal operation only about 500 microamps of mixer current will be required. Once the proper operation of the diode multiplier has been confirmed, the multiplier input and output couplings should be reduced until a mixer current of perhaps 600 or 700 microamps is realized. The final adjustment of the crystal current can be made conveniently by detuning one of the tube multiplier slugs (not the oscillator) or by adding a screen pot on the 6CB6.

The diode multiplier coupling reduction is governed by three considerations. First, the multiplier diode current should be kept below the burnout point, so a reduction of input coupling will provide extra safety margin in this respect. Second, it is desirable that the coupling between the input cavity and the multiplier cavity should be kept at a minimum to avoid signal loss to the multiplier line. If the 50 mc *if* is used this problem is minimized because of the separation of the resonate frequencies of the two cavities. However, if some other lower *if* is used this becomes increasingly more important.



Mixer assembly. Note coupling loop and injection capacitor tab.



TROUGH LINE BOX DETAILS
(INNER CONDUCTOR REMOVED)

Fig. 2

The two above considerations should be balanced against the importance of delivering sufficient excitation to the mixer diode.

As noted, if the *if* is low enough, some signal will be lost because energy is coupled into the multiplier line. This same effect will also occur in the reverse: injection energy can be lost by coupling into the signal line (and then into the antenna) when the signal line is tuned through the injection frequency. This effect will be indicated by a severe dip in mixer current.

This phenomenon can provide a convenient frequency reference. If your injection is below the desired signal frequency then you should tune your signal line to the high frequency side of the mixer current dip.

The final tune up requires a weak signal source. Either a test signal generator or an on the air signal will do. Connect the converter output to the input of the 50 mc converter. The signal line should be tuned for maximum output. Then tune the *if* output coil for maximum.

You should find that when the signal is removed, the mixer noise can be peaked with the *if* coil. If not, then the *if* coil may not be resonate or the output tap may require adjustment. It may also mean your *if* amplifier (50 mc rf amp) is not sufficient, though the average six meter converter should do quite well.

Every mixer diode has some value of mixer current at which it will produce the best noise figure and hence the best results.

If a noise generator is available it can be used for the adjustments. If not, the signal to noise ratio check should be used.

The procedure is simple. Starting with a mixer current around 700 microamps the current should be reduced in small increments

(about 50 microamps) and the noise figure or signal to noise ratio observed. At some point, probably above 250 microamps, the noise figure will be at a minimum and the signal to noise ratio maximum.

It would be well to point out that the signal strength will increase with mixer current. However, the noise will increase likewise. Therefore, signal to noise ratio, *not* signal strength, should be the only criterion for judgement.

Results

The final result of all this tuning and pruning should be well worth while. The mixer diode used was a 1N21C which is available very inexpensively both new and surplus.

The noise figure of this converter is in the neighborhood of 14 db. This is not outstanding, but is in keeping with the original premise that the noise figure of the basic converter is of only secondary importance.

This noise figure is low enough to cover quite easily with any of the better rf preamps.

The 416 B preamp described in an earlier article[1] does an excellent job, as do some of the better nuvistor and transistor preamps. Needless to say, a good paramp will outperform them all.

For those who feel they need a low noise figure in the basic converter, a more expensive mixer crystal would be a good start. The 1N21E sells for about $5.00 and the 1N21F for about $15.00.

Experimenting with the mixer loop size or the loop size on the input line would also be likely to produce some improvement. As previously stated, however the extra money and effort would probably be better spent on a hot front end preamp.

. . . K6MIO

Pictures by Joe De Young WA6CQL

1. 432 mc Preamplifier, Low Noise. 73 October 1964.

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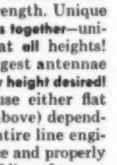

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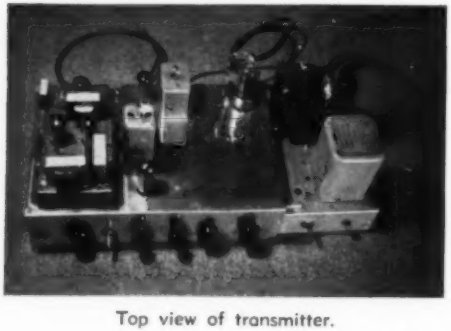
A New Approach to Phasing

This is not a blueprint for an exciter but rather, a collection of design ideas about phasing type SSB. You CAN design and build your own sideband equipment which will produce every bit as high quality signals as the store-bought kind. It may take a little time, but it saves cash and creates pride.

Glancing quickly at the basics of SSB, you will see that a balanced modulator is the heart of all single and double sideband exciters. The filter approach to SSB requires only a single balanced modulator, while the phasing method requires a dual arrangement.

The balanced modulator is the stage of the exciter in which an rf carrier (preferably not operating on the transmitted frequency) combines with the audio signal to produce sidebands minus carrier. It should be kept in mind that sideband is a type of AM, so don't be too rough on your Ancient Modulation friends. AM is referred to as A3 emission; SSB is A3j.

Have a look at the filter type exciters. They generate SSB on one frequency, usually crystal controlled, and heterodyne up or down to the operating frequency. This calls for a mixer stage following the balanced modulator. This is also good practice for the phasing exciters. A separate injection frequency provides much greater long-term stability to the rf phasing and the carrier nulling.



Top view of transmitter.

In building any exciter, filter or phasing type, there must be incorporated some special component. In the filter rig it's a mechanical or piezo crystal filter; in the phasing rig there is an R-C ninety-degree audio phase shift network.

The 90° audio phasing system about to be described was designed around the concept of using only standard off-the-shelf components. The results are extremely gratifying. Unwanted sideband rejection is ideal. Audio quality is good, comparable to the best on the market. The balanced modulator stays tuned up and nulled out for months of operation.

Before describing the phasing system, I would like to discuss the balanced modulator used with it. Fig. 1 illustrates a phasing type dual balanced modulator. Instead of using the expensive sheet beam tubes, this application calls for two economical dual pentode TV synch separator tubes, 6BU8's. The transformer windings L_1 and L_2 consist of pruned primary and secondary of an air core 455-kc *if* transformer, rewired as shown, and operating on 900 kc. The secondary, L_3, is about 150 turns

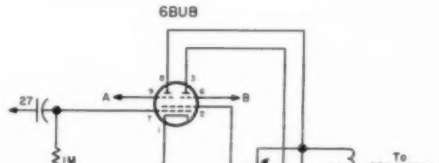


Fig. 1. 6BU8 dual balanced modulator

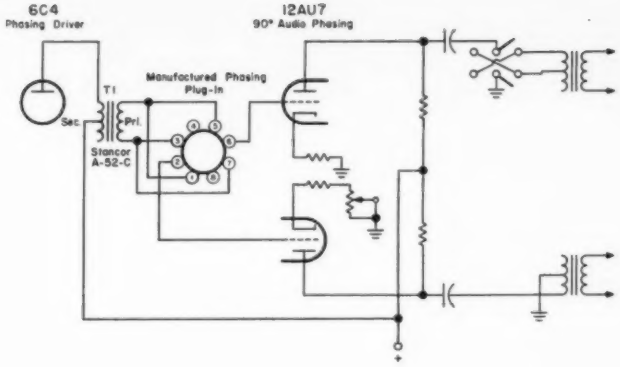


Fig. 2a
The usual audio phaser

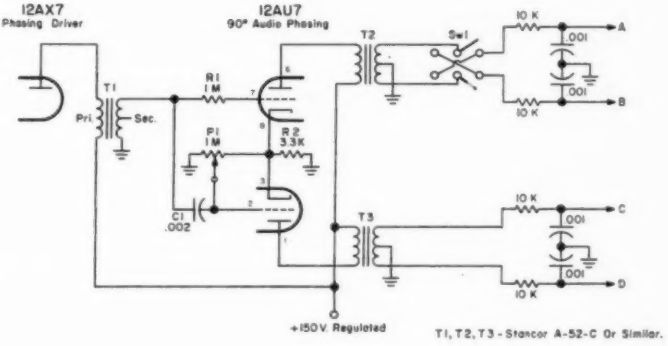


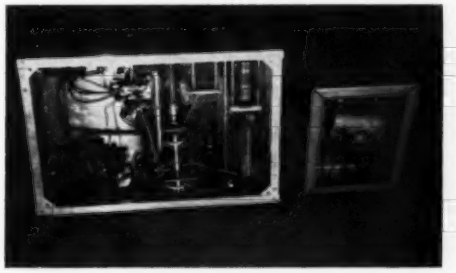
Fig. 2b
The Schmidt phaser

scramble wound Litz wire on the ½" diameter form between L_1 and L_2. Ninety-degree phased audio is brought to the suppressor grids through leads A, B, C, and D.

Fig. 2-a is an audio phase shifter for driving a type of dual balanced modulator.* It uses a manufactured plug-in R-C 90° audio phase shift network. Fig. 2-b is the author's original 90° audio phase shifter for driving the balanced modulator of Fig. 1. It is called the Schmidt phaser (with due respect to the originator of the Schmitt trigger). Note that both phase shifters are triode driven and employ transformer coupling in and out. In both phase shifters T_2 and T_3 should be the same type, but do not have to be a matched pair. Any single plate to push-pull grid type transformers should work. T_1, the Schmidt phaser input transformer should be a single plate to single or push-pull grid interstage type. The mic. preamp and phaser driver stages should pass little above 3,000 cycles.

The Schmidt phaser should be aligned with a 'scope (sweep disabled). Referring to Fig. 2-b, vertical deflection plates connected to the plate of V_{1a} or V_{1b} and horizontal plates connected to the opposite triode plate. Or, if your 'scope is dc coupled, then connect one set of deflection plates to A or B and the other pair to C or D.

Drive the phaser with a sine wave signal of 800 to 1500 cycles, and adjust P_1 for the best circle throughout the audio band. Maintain the input below the distortion level. Try voice input. The pattern should resemble a lace doily



* K8NIC/5 73 Apr. '62, p. 7.

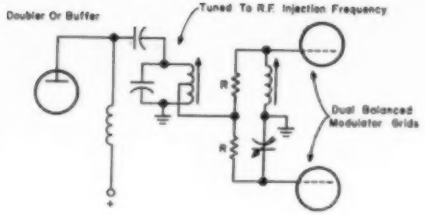


Fig. 3a. A typical 90° rf phasing circuit

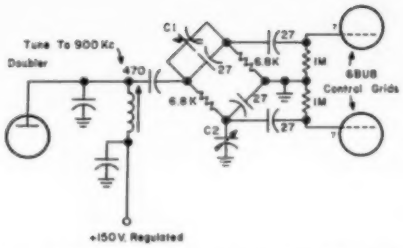


Fig. 3b. 90° rf phasing circuit preferred by author

due to voice wave complexity. The diameter will vary, but the pattern will remain essentially circular.

The Schmidt phaser makes use of the driving transformer inductance and the coupling capacitance, C_1, to accomplish the 90° phase shift. Theoretically this can occur at one frequency only. It is believed that R_1 and P_1 effectively lower the Q of the resonant circuit, extending the 90° phase shift throughout the speech frequency band.

But the adjustment of utmost importance is the phasing of the rf injection to the balanced modulator stage. Fig. 3-a and 3-b are suggested circuits for driving the 6BU8 control grids with 90° phase rf injection.

Fig. 3-b is preferred by this writer. This is an R-C bridge used by Heath and others. C was chosen at 27 mmfd. Its capacitive reactance at 900 kc is close to 6700 ohms. Resistors, R, were 6800-ohm composition type. Two small ceramic trimmers, C_1 and C_2, are in parallel with the phasing capacitors. Their purpose is to compensate for inequalities in resistance, stray capacity due to lead dress, etc. Coupling capacitors to the 6BU8 control grids are 27 mmfd. Grid leak values are 1 megohm.

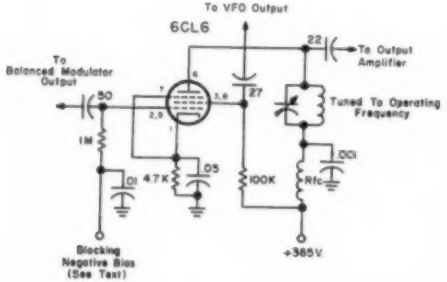


Fig. 4. Mixer with conversion gain

It is difficult to use a 'scope to check the rf phasing here due to stray lead capacity between the exciter and the 'scope. But the rf injection phasing *must* be very close to 90° or the signal will not be clean.

The injection frequency to the balanced modulator, 900 kc, was chosen because of (1) the availability of 450 kc crystals at 10c each, and (2) the desire to use one dual triode as a crystal oscillator and an un-neutralized isolation stage. A 12AX7 fills the bill by working as a crystal oscillator and doubler. It happens that 900 kc injection also produces a higher image frequency after mixing than 450 kc injection, giving an added bonus of less possibility of spurious emissions being transmitted.

Your VFO can operate either 900 kc above or 900 kc below the desired operating frequency. Sidebands are switched by Sw_1, Fig. 2-b.

On the subject of mixing, it was desired to select a mixer tube which would render some conversion gain. (See Fig. 4.) A 6CL6 was chosen for this purpose. Its control grid receives the balanced modulator output, while the screen grid is driven from the VFO output (about 10 to 15 volts rf) superimposed on the normal screen grid dc potential. The mixer output then drives a 2E26 output Class-A amplifier directly without the use of any buffer stage.

In operating the exciter the microphone preamplifier and phaser driver 12AX7, the oscillator-doubler 12AX7, the Schmidt phaser 12AU7, and the balanced modulator 6BU8's all operate continuously from a 150-volt regulated supply. The 6CL6 mixer and the 2E26 output stage are supplied with 365 volts unregulated, continuously supplied also.

The two stages receiving the 365 volts are blocked-grid keyed. Blocking bias is obtained from a voltage divider to ground from either hot side of the power transformer. A point of the voltage divider feeds a single silicon diode

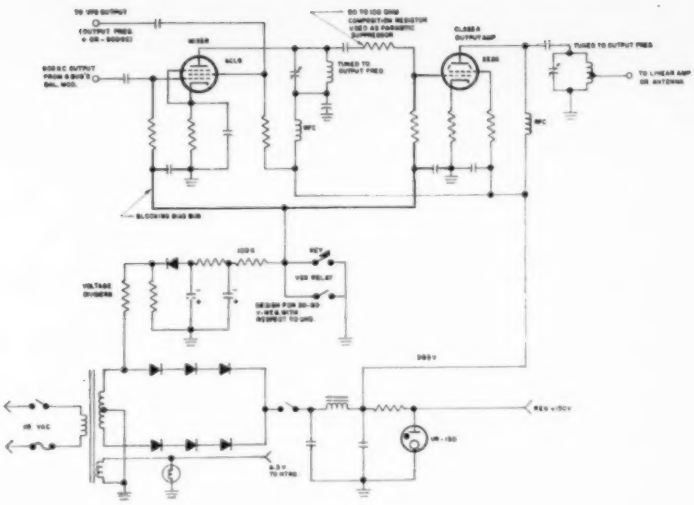


Fig. 5.
Blocked-grid
control system

and an R-C filter to produce 80 volts dc negative with respect to ground. (See Fig. 5.) This blocking bias voltage is fed to the grids of the stages to be blocked through a 100-K series resistor and thence through their respective grid resistors. The keyed stage grid leak resistors terminate in a common bus rf bypassed to ground.

Closing the key or VOX relay connected between the blocking bias bus and ground effectively short circuits the control grid's portion of the blocking bias, allowing normal grid leak bias to control tube emission. At the same time the bias supply is only grounded through a 100-K resistor, so the supply feels only a very light load. As soon as the ground is removed from the keyed grid circuit bus, the negative bias on the grids skyrockets and blocks plate current flow. Some of the best modern factory-built equipment employs this ancient trick.

Block-grid keying is extremely fast and relatively clickless. Using this method, the key becomes a "push-to-talk" switch on sideband and a key on CW (with carrier re-inserted). If you already have VOX and prefer it, simply wire the VOX relay across the key contacts for the dual function. All of this control jazz

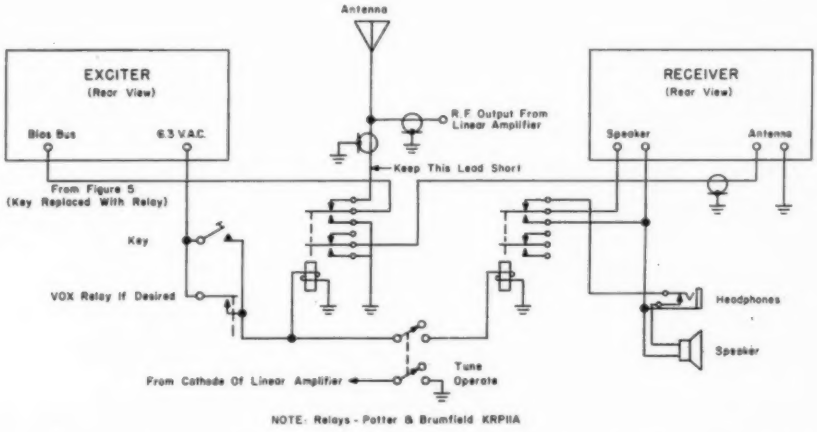


Fig. 6. The engineered system. The "tune-up-operate" switch allows you to talk yourself on frequency

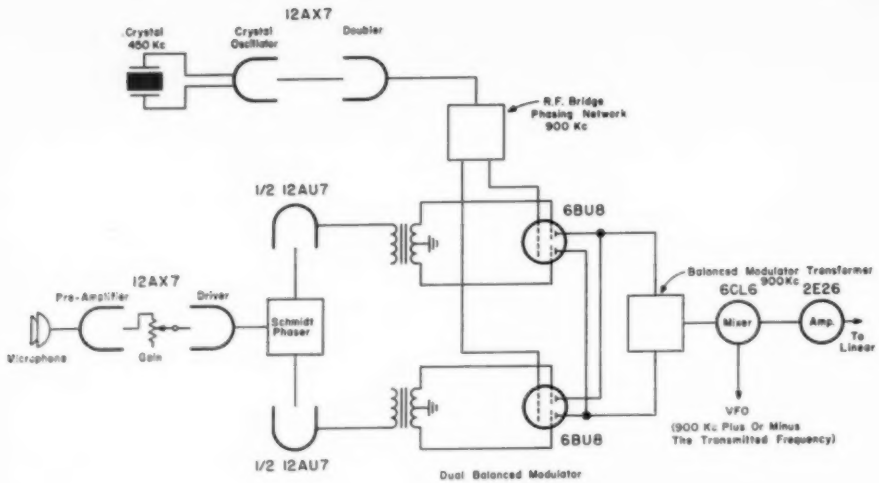


Fig. 7. Block diagram of W9IDP SSB exciter

is really what is referred to as "systems engineering," which means making the components in your station into an integrated "system."

In order to complete the systems engineering of the station layout, and some hams do encounter trouble in this department, the arrangement of Fig. 6 is suggested. A 6.3 volt filament lead is brought out from the power transformer to operate a pair of good quality 6-volt ac relays. These will key well up beyond 25 wpm, so have no fears about CW unless you operate 50 to 60 wpm.

The control functions to be accomplished by the relays are:

1. Receiving antenna disconnect; receiver antenna input grounding.
2. Speaker muting.
3. Transmitter keying, either by hand key, VOX relay, or "tune-up" switch.

Be sure to install the relays inside of some kind of box away from the exciter chassis and away from the microphone. The relay snap goes on the air with a very distinct "clack" otherwise.

We have discussed the balanced modulator and its audio drive and rf injection, the Schmidt phaser, the importance of proper rf phasing into the balanced modulator grids, a dual balanced modulator for phasing exciters employing inexpensive tubes, a mixer with conversion gain, blocked grid keying, and the engineered system.

If nothing else is remembered, let one thing sink in. That is this. The rf injection to the balanced modulator must have as good 90° separation as it is possible to attain.

Use a good SSB receiver to adjust your transmitter before going on the air. A well shielded receiver with antenna input grounded can tell you a whole lot about your signal. First give a listen on the frequency. (Some hams are sensitive about people who test before listening.) Then ground the receiver antenna input with a very short wire, and make a short transmission with the rf gain of the receiver backed all the way down and the antenna trimmer rotated for minimum signal. Use the cans for this test. If the quality of your signal sounds good on this test, you have a pretty good chance of sounding good on the air.

Don't feel embarrassed at having to ask for criticism of your signal from fellow hams. Some of them with the store-bought kind tend to be a little too honest with the experimental gear types. But amateur radio is supposed to be a place where radio frequency experiments may be conducted. Hams can emit all types of signals. We are permitted FM, RTTY, single sideband, double sideband suppressed carrier, and even double sidebands with carrier.

During the process of developing the Schmidt phaser, the dual balanced modulator with 6BU8's, and the 6CL6 mixer, my signal was not always the best on the air. When concurring poor signal reports were received, though, I tried to do something about it. This is it, and I think you'll like it. . . . W9IDP

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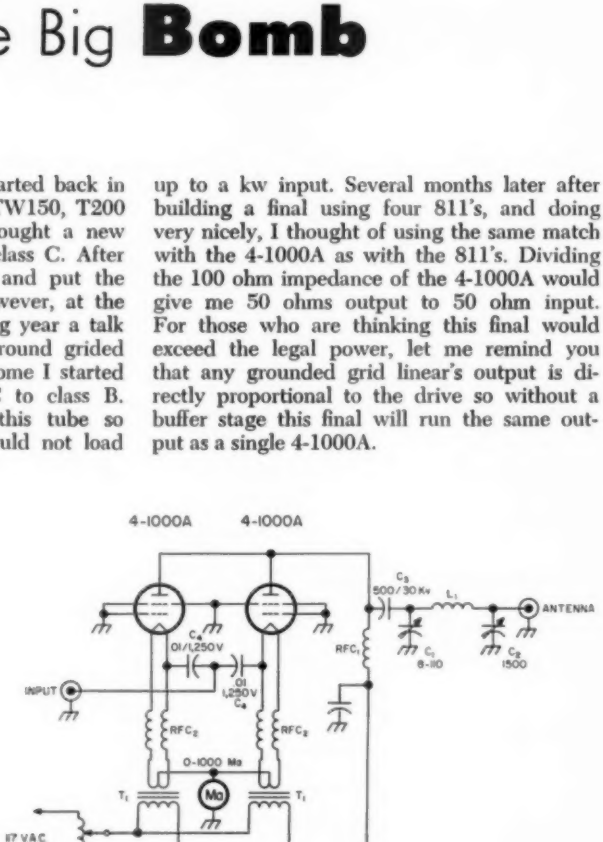
The Big **Bomb**

The final of this transmitter started back in 1957. After running a kw with TW150, T200 and 250TH's I went out and bought a new 4-1000A and tried to put it in class C. After a year of confusion I gave up and put the final under the work bench. However, at the National Convention the following year a talk by Rex Bassett W4QS on the ground grided 4-1000A fired me up and once home I started changing my final from class C to class B.

I knew little about driving this tube so with 3000 volts on the plate could not load up to a kw input. Several months later after building a final using four 811's, and doing very nicely, I thought of using the same match with the 4-1000A as with the 811's. Dividing the 100 ohm impedance of the 4-1000A would give me 50 ohms output to 50 ohm input. For those who are thinking this final would exceed the legal power, let me remind you that any grounded grid linear's output is directly proportional to the drive so without a buffer stage this final will run the same output as a single 4-1000A.



The Big Bomb

Two tubes will permit the operator to coast along at low voltage without any tuning of the grid and without a matching transformer to get the desired kw input. Who knows how many years these tubes will rest at this voltage and current. As the photo shows there is a Powerstat which changes the dc voltage and my checks show it is not necessary to run these tubes (one or two) at 5000 volts to get maximum efficiency. With a plate voltage of 3000 volts, an efficiency of 70% has been checked. Other advantages include the following; no grid circuit, no neutralization, rapid band change (plate circuit only), no relay as plate voltage on at all times, making more desirable for remote operation since no screen and grid voltage are required. No danger of overloading capability of tubes with excellent linearity and stability. Photo also shows Powerstat on filaments which used with care can prolong the life of tubes. (Play radio engineer: bring the filament voltage up slowly and maintain the required filament voltage. Let the tubes cool off slowly after use.) The driving requirement matches perfectly the exciters now on the market; HT32, HT37, 32S3, 200V etc.

The circuit is very basic. Just parallel the plate and filament leads. Five meters are used reading from left to right; Grid & Screen 0-500 ma, High voltage 0-5000 vdc, RF output 0-8 amp., Filament voltage 0-15 vac., Plate current 0-1000 ma.

I desired maximum efficiency so I chose single band operation. Changing bands can be accomplished in seconds with separate coils. The power supply is a standard bridge using 4 872's. Since completion of the rig I have also tried solid state rectifiers using the Westinghouse silicon rectifier Oz-Pak for the past five months with fine results. The plate transformer is a 5 kva pole pig (7200 vac) bought through the power company most reasonably. It is controlled by a Superior Powerstat with a rating of 28 amps. The cabinet is by Par-Metal using 30" panels. Filter condensers are 2 GE 120 μf @ 3000 volts. In series they give 60 μf at 6000 vdc. Chokes are in the negative lead and improved regulation is achieved by using swinging and smoothing chokes in series. Without parasitic chokes in plates leads the final was stable with voltage up to 6000 without any signs of taking off. My driver is a 32S1. I run 3500 volts for legal input knowing that I should be in business for many many years without tube failure or other types of breakdowns.

. . . WØSYK

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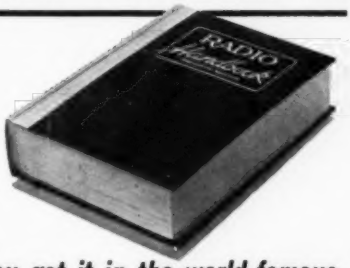

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R. F. Van Wickle W6TKA
643 Aurora Avenue
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Two for Two

Here are two easy-to-build antennas for two meters. Either can be used for fixed or mobile operation, but I prefer the 'J' on the car, and the coaxial (or sleeve) antenna on the house.

The J is popular for mobile operation here in California. One drawback to the antenna is that it can sometimes be difficult to construct and cumbersome in appearance. The W6TKA-J eliminates those problems. The mounting for the J consists simply of an aluminum bracket bent in the shape shown in the drawing and photograph, with a UHF-type coaxial panel connector mounted on the bracket. The bracket is held in place just inside the trunk lid by two sheet metal screws. A single hole through the lip of the trunk opening takes care of the RG-59/U cable running to the transmitter. Thus, no noticeable holes have to be drilled in the car to mount the antenna. Also, please note that this J is fed directly at the base with coax, and not at a 300-ohm point through a bulky balun.

It might be well to explain that the J is nothing more than a half-wave antenna fed with a quarter-wave matching section, consisting of the lower 19-inch section with the longer element spaced something less than

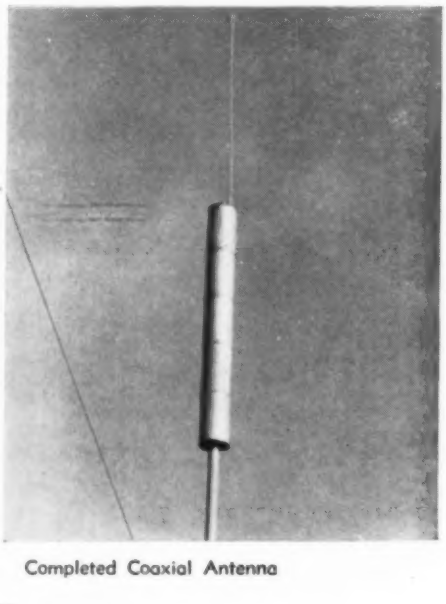
W6TKA-J Mounted on Car

two inches away. The J is *not* a three-quarter wave antenna, as I have occasionally heard it described. The lower 19 inches of the element that becomes the antenna and the second, grounded 19-inch section, do not radiate. As a matter of fact, if the long radiating portion of the antenna were bent at a 90° angle to the matching section, you'd have the old-fashioned "end-fed Zepp."

The antenna is built around a PL-259 UHF-type coaxial connector. Both elements are ¼ inch half-hard brass rod, available from almost any metal supply house. Dimensions for the two elements are given in Table I.

The long piece of rod must be carefully filed until it will slip into the pin of the coaxial connector. The filed end of the rod and the inside of the connector pin are then tinned, and the rod "sweated" into place. Do not force the rod into the connector or the connector insulation may fracture.

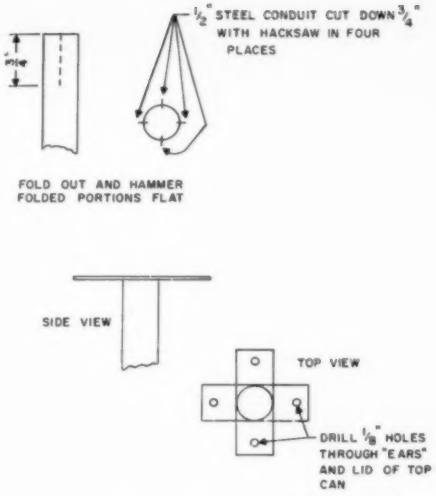
Next, the shorter element is prepared. Make a 90° bend 2¼ inches from one end of the rod.



Completed Coaxial Antenna

TABLE 1
"J" Antenna Dimensions

Frequency, Mcs	Length, In., Short Section after bending	Length, In., Long Section above connector
144	19¼	38½
145	19⅛	38⅛
146	19	38
147	18¾	37¾
148	18⅝	37½


½" STEEL CONDUIT CUT DOWN ¾" WITH HACKSAW IN FOUR PLACES
FOLD OUT AND HAMMER FOLDED PORTIONS FLAT
SIDE VIEW
TOP VIEW
DRILL ⅛" HOLES THROUGH "EARS" AND LID OF TOP CAN

DETAIL OF END OF CONDUIT PREPARATION FOR MOUNTING COAXIAL SLEEVE. REFER TO TEXT.

See Table I for the correct rod length. Then bend the last 1¼ inches of the 2½ inch section into a semi-circle of the same inside diameter as the outside diameter of the upper portion of the connector. Tin both the upper part of the connector and the loop that you have formed, and solder into place. At this point the shorter element will be spaced between 1½ and 1¾ inches from the longer element.

The upper part of the connector is now packed with small pieces of polystyrene foam, taking care to keep the antenna centered within the plug. Then, when the foam has been tightly tamped into place, use polystyrene cement to disolve the plastic. When dried, you will have a low-loss insulator which will keep the antenna centered in the plug.

To maintain the correct spacing between the elements over the entire length of the shorter element, a piece of plastic rod the same length as the spacing between the elements (as measured just above the connector) is placed near the top of the shorter element. In our case we used a plastic spreader taken from 450-ohm TV open-wire line. About ¾ inch of the TV wire was left extending on both sides of the insulator, and the wires twisted around the two antenna elements, and then held in place with plastic electrical tape. As a finishing touch, the entire antenna (except for the insulator and the connector, which were masked with masking tape) was spray painted aluminum, and the plastic tips

TABLE II
Coaxial Antenna Dimensions
(Same dimensions apply to both sleeve and radiator)

Frequency, Mcs	Length, In.
144	19¼
145	19⅛
146	19
147	18¾
148	18⅝

from an old "rabbit ears" indoor TV antenna were placed on the ends of the two elements.

The antenna is easily removed when garaging the car, and has little wind resistance. Best DX to date—with one watt output from the transmitter—was a station in San Diego, California, contacted while driving through downtown Los Angeles—a distance of some 100 miles.

Now for the coaxial vertical antenna. There we used frozen orange juice cans (yes, other flavors will work!), and soldered them together. Five cans, each 3¾ inches long, with both ends removed (except for the top can, which has one end left in) were used to make up the sleeve. Using tin shears, the lower can is trimmed so that the overall sleeve length corresponds to the dimensions given in Table II. One word of caution: not all frozen juice cans are steel. Some are aluminum—even within the same brand we found both metals being used—so choose the cans with care. If a can won't solder, chances are it is not steel.

A small ceramic feed-through insulator (E. F. Johnson No. 135-44) was installed in a hole drilled in the top can lid, and the center conductor of RG-59/u coaxial cable connected to the insulator stud. The braid of the coaxial cable is soldered to the inside of the top can.

Next, take a ten-foot length of one-half inch steel "thin-wall" steel conduit, available at hardware or electrical supply stores. Split one end using a hacksaw as shown in the sketch. Feed the coaxial cable down through the conduit and out the other end. Then fold

Mobile J Antenna Mounting Bracket

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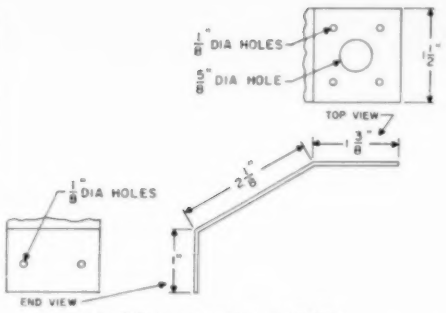

J ANTENNA MOUNTING BRACKET

back the slit portions of the conduit so that it will fit tightly into the end of the can in which you have installed the insulator. Then drill at least two holes from the lid side of the can through the lid and through the split portions of the conduit. Use sheet metal screws to hold the lid in place.

The next problem is soldering the cans together—which really isn't much of a problem if you have a good 100 watt iron, *non-corrosive* soldering flux, and resin core solder. First, "tack" each can in place with solder at about four places around the periphery of the can. Then go back and solder heavily all the way around. I laid the assembled portion of the antenna flat and held the cans between stacks of old books.

When you finish, you should have something that looks like the antenna shown in the photograph—except, of course, for the radiator itself, which we have not yet installed. Now take a piece of polystyrene foam and cut it circularly the size of the inside diameter of the lower can. Make the foam just a little oversize, so it will fit tightly. Then, cut the piece of foam in two, cut a semi-circle in each half for the conduit, and put the two pieces in place to hold the end of the assembled sleeve equidistant from the conduit.

Now cut a piece of aluminum clothesline wire (see Table II for correct length). Make a 90° bend in the wire at a point one-half inch from one end. Then bend the one-half inch portion into a semi-circle so it can be attached to the insulator. It will probably be necessary to use two ¼-inch washers on the insulator to attach the antenna securely.

And that's the coaxial antenna. Just mount it where you want it, by means of clamps to a mast or the side of the house, run the coax where you want it, and you're on the air.

With the J on the car and the coaxial on the house, you can drive around the block talking to yourself!

. . . W6TKA

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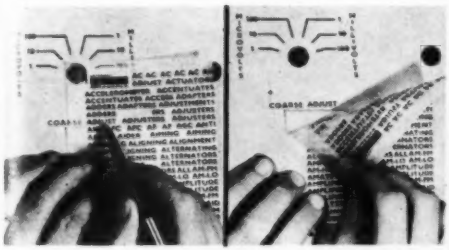

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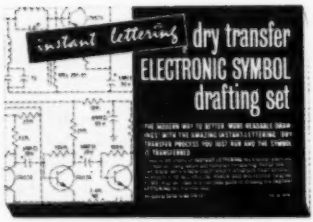

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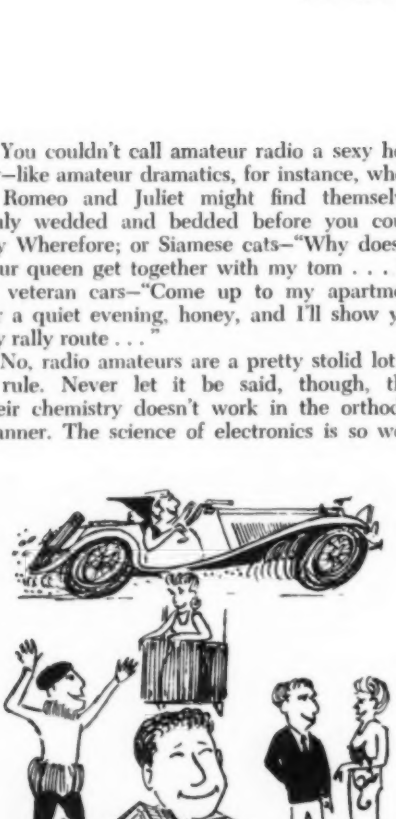
The Trouble With Fred . . .

You couldn't call amateur radio a sexy hobby—like amateur dramatics, for instance, where a Romeo and Juliet might find themselves truly wedded and bedded before you could say Wherefore; or Siamese cats—"Why doesn't your queen get together with my tom . . . ?"; or veteran cars—"Come up to my apartment for a quiet evening, honey, and I'll show you my rally route . . . "

No, radio amateurs are a pretty stolid lot as a rule. Never let it be said, though, that their chemistry doesn't work in the orthodox manner. The science of electronics is so wonderful that the time may very well come when other arrangements might be possible. Until then radio amateurs are apt to come to heel eventually, no matter how great their resistance. That was the trouble with Fred.



You couldn't call ham radio a sexy hobby—like dramatics or vintage cars, or Siamese cats . . .

There are nine amateurs in our town and we stick together for mutual protection as much as for personal friendship. It's far easier to hunt the DX in an organised pack than to have everybody QRM'ing everybody else. TVI sorts itself out more easily when friends rally round to help. The wives can get together, too, to air their mutual grievances. That was our downfall.

For Fred and I were true friends, besides having the hobby in common. We had gone to the same school and the same college—he to study accountancy, me to learn engineering. We were the best of buddies.

The trouble with Fred began when his mother, after ten decorous years as a widow, threw her heels over her head and married a guy out on the West Coast. She signed the old house over to Fred and off she went, leaving the poor boy to fend for himself. I guess she thought he should be O.K., pushing 40 as he was. He had the house he had grown up in and Myrtle, who came in twice a week to clean. What more did he need?

He needed plenty. The old lady had spent her lonely years spoiling him like the big baby he resembled. For Fred, with his round face, big cuddlesome frame and helpless expression, had the sort of little-boy-lost look that sets the hormones buzzing in any woman, from nine to ninety. They all wanted to mother him. He had been efficiently mothered for forty years and suddenly had to look after

himself. The result was chaos.

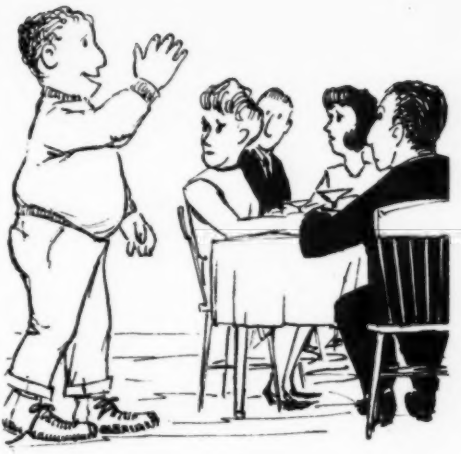
His shirts, for instance; he came to our house one night with one button obviously missing. Later that week I noticed two buttons adrift. He seemed blissfully unaware that anything was wrong but, when he came the third time with more buttons missing than present, Janet, my wife, offered to do a little mending for him. He came next day with a grip full of perforated socks and buttonless shirts. It took Janet a week to get him mended again.

Food was an even greater problem. His own catering experience was rudimentary and that chubby body took a lot of stoking to keep it comfortable. He ate occasional meals in a road-side joint, where he got nothing but heartburn. Myrtle fixed him something now and again, but a man has to eat more than twice a week. So Fred got to dropping in at our house just before meal-times. What could Janet do but offer him lunch—or dinner—or breakfast—or a midnight snack when there was a contest on? No housewife could bear to dish up good food with a lonesome man watching, drooling and eyeing the apple pie wistfully and with affection, especially when the man was someone as appealing as Fred and the housewife as tender-hearted as Janet.

As I say, Fred was a regular visitor. Sometimes, though, Janet would have arranged a dinner party, with all the best china, glass and silver, with linen napkins instead of paper and an equal number of men and women. It might be an important client of mine we were entertaining, or some old friend from Janet's schooldays for whom she wanted to put on the style. There we'd be sitting, all dressed up, with me mixing martinis as if we had them every night, and the conversation going nicely —easy and sophisticated and plenty of status symbols showing. And in would lumber Fred to tell me that a ZD9 was on. Fred would be wearing sneakers and an old sweat shirt but who would have the heart to send him away?

We weren't the only victims of course. Fred was engaged for weeks helping Bert to build a sideband rig—takes time and care to do a job like that. And a man can build up a hearty appetite. So Bert sat Fred down and very appreciative he was, for he loved home-cooking and it had been his mother's boast that no store-cake ever crossed her threshold.

One weekend George put up a log periodic, the first in our area. It was just like Field Day, with people driving in from miles around on the Saturday to help or to admire. Doris



Fred would drop in on a dinner party dressed in sneakers and a sweat shirt . . .

fed them all coffee and pie but, when everyone had gone home, there was Fred still helping George, so Doris had to invite him to supper and to stay the night, so that he and George could make an early start on Sunday morning—after a huge breakfast.

So there it was. We all genuinely loved the big lug and enjoyed his company. It was the wives who ganged up on us—they decided it was time Fred got married.

George and Bert and I did our very best to protect him. We argued, pleaded, threatened but Fred's fate was sealed. It was just a question of finding the girl. This presented the wives with a serious obstacle which delayed their plans for a while. We thought it might render our friend safe, for we knew our Fred. He was terrified of women. Married women, particularly those who fed him, were OK but if a single girl so much as breathed on Fred, he would hang his head, his baby-soft skin would flush the prettiest and most appealing shade of pink and he wouldn't say a word. Fred's conversation was limited entirely to radio. He lived radio. Jayne Mansfield might be the answer to my prayer, or Bert's or George's. All Fred would ask was did she work AM or SSB?

This, you understand, had considerably hampered his sex life so far but Fred didn't seem to mind. There was always food as consolation.

So the girls had themselves a problem. And the girls solved it and in the most cunning, dirty, under-handed way . . . after all, Fred was a sitting target, plump and ripe and

tempting, eligible and attractive and well-heeled, just waiting for the first predatory female who could demonstrate a devoted, nay, an obsessional love for amateur radio.

Doris' niece arrived in town. I suppose she could have been called a nice-looking girl, even if a bit too managing for my liking. She intended making somebody a wonderful mother, even if it was Fred, to begin with. That didn't justify the iniquitous plot that our wives concocted . . . they sold the idea to Patsy in one marathon session, when we were too involved working the sideband contest to stop them. Next thing I knew was that my ARRL Handbook mysteriously disappeared for some weeks. So did George's RSGB Handbook. Even then we could have rescued Fred if we had realised that the books had been smuggled out to a very clever girl with a retentive brain, determination and desire for a husband.

The trouble with Fred came to a head at Christmas, when all the local amateurs and their wives got together for a party—there being no contests to work that weekend.

Doris brought her over to us—I remember so clearly, in the same way that a picture of a fatal disaster remains clearly etched on the victims' memories. There were George, Bert and I, happily discussing the possibility of fitting mobile sideband transceivers, when up slithers Doris. You could almost hear the rattle at the end of her tail. Beaming at her side was this dame, Patsy.

"Hello, Fred," hissed Doris. "Do you know my niece, Patsy?" And off she coiled, leaving Fred to go into the mumbling and blushing routine. Never will I forget what happened next. It was cruel, heartless. It wasn't cricket. Nor was it baseball, football, handball or tennis.

Fred was left alone with Patsy . . .

"I heard you men discussing sideband transceivers," said Patsy brightly, "Tell me—what kind of sideband generation do you use—crystal filter, phasing or mechanical filter?"

It was horrible to see. Fred raised his head. *This* he had never seen. Then he proceeded to tell her, in very great detail, exactly which kind of SSB generation he did prefer—and why. Our Fred, roped and bridled, trotted meekly into the corral, waiting for his saddle.

They were married within weeks. There was nothing to delay them. Patsy moved into Fred's house and shared not only Fred's bed but his cubical quad too.

Of course they were happy. And Patsy had learned just enough amateur radio to trap Fred, but her interest was aroused and those first blissful, honeymoon weeks must have been interspersed with passionate lessons on circuit diagrams and regulations, for soon Patsy had a call of her own.

A year went by and, for the first wedding anniversary Patsy had Fred buy her not diamonds, not mink, but a genuine 5-carat furrier-designed linear, which must have set him back a helluva lot but that's what a guy will do for love. Theirs was now the biggest signal in the town and you could see this in Paty's attitude to the rest of us—a kind of patronage which we began to resent.

I should have known it was to be big trouble when, some weeks after Fred and Patsy had gone up into the linear class, Bert mentioned to me casually that Fred had visited them the previous evening and stayed for supper. It seemed that Patsy had a sked she just couldn't miss and there was no time to cook supper. Then one day he arrived at our house just before lunch. He plainly had all the time in the world to spare, for Janet called me twice for lunch. Then she came into the shack to find me.

"Hurry and wash," she said, "Lunch has been ready for ten minutes already. I guess Patsy has your lunch waiting for you, too, Fred."

"Well, Janet," said Fred—and it was quite like old times—"you see—Patsy has been kinda busy this morning. There's a ZD7 coming up on 20 and she needs him to make her century—so she just didn't get around to cooking . . ."

It was while Fred was tackling a king-sized portion of Janet's pot-roast that I noticed there were two buttons missing off his shirt.

. . . Sylvia

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The new Receiver-controlled Exciter...

DRAKE T-4 RECITER + **DRAKE R-4 RECEIVER** = The Transceiver with the MOST!!

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Covers MARS and Other Frequencies between ham bands.
Upper and Lower Sideband on all frequencies.
Automatic Transmit Receive Switching on CW (semi break-in).
Controlled Carrier Modulation for AM is completely compatible with SSB linear amplifiers
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Any ten 500 Kc ranges between 1.5 and 30 Mc can be covered with accessory crystals... (160 meters, MARS, etc 5.0-6.0 Mc not recommended).
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R. L. DRAKE COMPANY MIAMISBURG, OHIO 45342

A Versatile Oscilloscope

Harvey R. Pierce WØOPA
5372 E. Bald Eagle Blvd.
White Bear Lake 10, Minnesota

In my previous articles in 73 Magazine I described the "Simplescope" monitor and then a more advanced design in "Complicating the Simplescope." Both of these were excellent monitors, but the Simplescope was limited to monitoring high-level AM, and the improved version merely added a wide-band vertical amplifier so it could be hooked to a receiver.

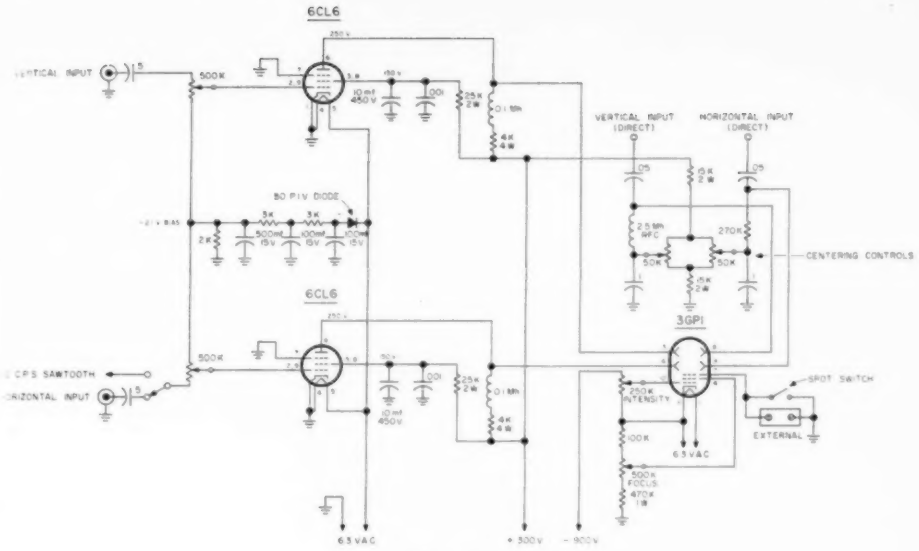
I felt there was a need for a more advanced design: something that could be used with low-level modulators as well as high-level, for SSB and DSB, and with receivers, provided this could be done without at the same time being too expensive or too complicated for the ham builder. A sort of minimum oscilloscope for all-around monitor use, but not necessarily for other scope purposes.

With the above in mind, specifications were drawn up. For low-level work, wide-range amplifiers for both horizontal and vertical deflection would be necessary, and these amplifiers should have fairly high gain and no phase-shift to blur the pattern. The scope should have direct input to both vertical and horizontal plates for high-level work, and for frequencies above the range of the amplifiers. Construction should not require expensive or hard-to-get parts. The circuit should be as simple and fool-proof as possible. Centering controls should be used, and a 60-cycle linear sweep would be nice if the circuit was simple.

The diagrams and pictures show what was done. The 6CL6 video amplifier circuit used in "Complicating the Simplescope" had proved satisfactory so it was used again, with minor changes. (See Fig. 1) A small (1/10th mhy) rf choke was added in series with the 6CL6 plate load resistors to improve the response at the high-frequency limits. The 6CL6 plates connect directly to the deflection plates to avoid phase shift. A bias supply for the 6CL6 grids was added to prevent any low frequency degeneration from cathode bias. Identical amplifiers were used for vertical and horizontal deflection.

The amplifiers connect to only one of each set of deflection plates, and direct input is available to the other two plates. The direct input plates also connect to the two centering controls. Of these two, the vertical plate is isolated (decoupled) from the vertical centering control by a 2½ mhy rf choke, allowing high-level rf to be fed to it, while the horizontal plate is decoupled from the horizontal centering control by a 270k ohm resistor, allowing either high-level af or rf to be fed to it. Both plates are connected to the direct input connectors by capacitors, and if direct input is not used, the connectors may be grounded, thereby bypassing these unused plates to ground.

When the amplifiers are not in use, the low



Versatile oscilloscope

impedance of their plate circuits (less than 5,000 ohms) keeps them from having much effect on the direct deflection.

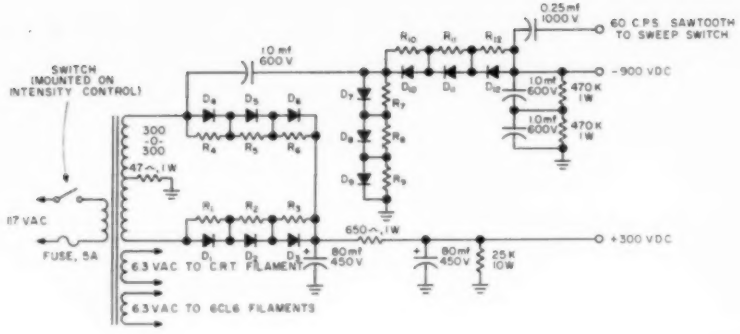
The power supply (see Fig. 2) uses a TV power transformer and low-cost silicon diodes in series as rectifiers. The diodes save space and heat. Resistors equalize the voltages for the diodes. A conventional full-wave rectifier supplies a positive 300-volts for the amplifiers, while a voltage doubling circuit supplies about 900 volts negative. Together they supply about 1200 volts for the cathode ray tube (crt). The voltage doubler produces about 6 volts of beautiful 60-cycle sawtooth ripple, which is used for the linear sweep voltage.

Provision is made for blanking the spot by opening the lead to the last crt anode, either by a front-panel switch ("Spot Switch") or remote relay. This blanking is desirable during standby periods to prevent burning of the phosphor screen by an unmoving spot. Other methods of blanking can be used, but this seemed the simplest and involved nothing but ground potential.

In building this instrument, primary consideration was given to short grid and plate leads because of the high frequencies involved. (See Fig. 3). Second came ease of construction, then cost and size. Last came cabinet or enclosure. The basic design, as shown in the pictures, consists of two aluminum plates, one at each end of the crt. A third plate forms the rear, on which is mounted the power transformer, fuse, and all connectors. The three plates are held together by four threaded rods, one at each corner.

The cabinet shown in the pictures was an experiment. It is made of one eighth inch tempered hardboard covered on the smooth side by self-adhesive vinyl film and on the inside by thin sheet aluminum. It is held together by outside-corner molding for wall tiles (from Sears, Roebuck) and the four tie bolts. The ventilation holes are backed by perforated

Rear view. Connections for remote control of spot to the right of transformer, fuse and ac connector on left. Input connections (3-way binding posts) across the top. Handle at rear top for balance.



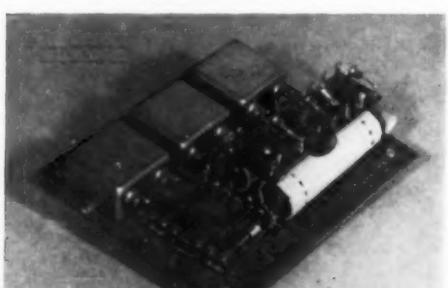
$D_1 - D_{12}$ - 500 Ma, 400 PIV
$R_1 - R_{12}$ - 820 K, 1/4 W

Oscilloscope power supply

aluminum. While it made a fairly handsome case, it proved as hard to build as the scope itself, so some more common method is recommended.

The aluminum plate at the rear of the crt is the main "chassis" and its layout (Fig. 3) should be followed closely in the interest of short leads and maximum high frequency amplification. With a little care, the 6CL6 sockets can be positioned so their grid lugs can be soldered directly to the center lug of the adjacent gain control, and their plate lugs a minimum distance from the crt deflection plate pins. Position the 60-cycle/audio sweep switch for shortest leads to the horizontal gain control, and keep the lead away from the chassis.

Crt sockets are hard to come by, so in this case a hole was cut in the chassis to clear the crt base, and a clamp devised to hold the tube firmly in position. Connections were made to the tube pins by socket clips and flexible leads obtained from three discarded TV picture tube sockets. Your local TV service man may have a few to spare. Or you can make your own leads using clips from old octal sockets. Use insulation tubing over the clip lugs to avoid shorts and allow enough slack in the leads to permit rotating the crt 30 degrees or so later to level the horizontal trace. The keyway ridge of the crt base should be on the bottom.



The rectifier/filter sub chassis. High-voltage diodes in foreground,, high voltage capacitors in rear. Low voltage diodes on terminal board above the two 80 mfd capacitors.

Vertical and horizontal centering (positioning) controls are mounted directly below the gain controls. Between them, below the tubes, tie-points are placed as needed to support the amplifier and bias supply components, and a long, multi-point strip is placed along the bottom edge of the chassis plate for the connections to the other units. (Transformer, front panel, rectifier/filter sub chassis.) The shaft extensions shown in the pictures are birch dowel (cheap) but metal is best.

To conserve space, the large electrolytic capacitors for bypassing the 6CL6 screens and for the bias supply were placed on the tube side of the chassis. The screen connections were brought through the metal by feed-thru capacitors, for better bypassing at the high frequencies. If preferred, .001 or .005 mfd disc ceramics connected at the tube socket lugs could be used in place of the feed-thrus.

A hole is cut in the front panel about ¼" greater in diameter than the crt face and the tube is cushioned by four soft rubber grommets pushed into slots around the hole. On this panel, below the crt face, are mounted the focus and intensity controls and a pilot light. (The latter may be omitted, if you wish. If

used, a light shield must be provided to keep it from shining on the crt face from the back.) The power switch is on the intensity control.

To insure proper alignment of shaft bearings, tube face, and tie bolts, this panel and the main chassis should be clamped together and small centering holes drilled thru both sheets for all holes common to both. These holes may then be enlarged to the sizes needed. In the scope pictured a separate "dress" panel was used to cover the grommets, bolt heads, etc. A hint—it is a big help to use color-coded wires between this panel and the main chassis.

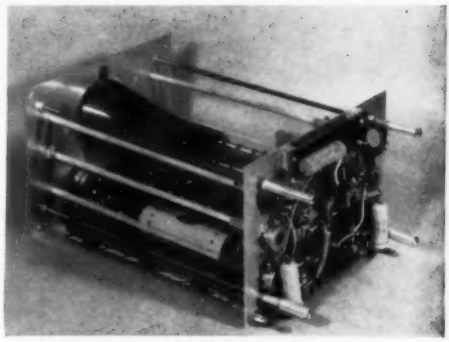
Rectifier/filter/bleeder components are mounted on an insulation board that clamps to the tie bolts, underneath the crt. The placement of parts will depend a great deal on the size and shape of the capacitors used. In the picture the full-wave diodes are mounted on an insulation strip over the two 80 mfd electrolytics, and the voltage-doubling high-voltage diodes on one corner with their metal-cased capacitors along the edge. Bleeder and filter resistors are underneath, as is a tie-point strip for the connections to the transformer and main chassis.

The power transformer is mounted on the rear panel so the crt will be as far from its magnetic field as possible. All connectors are on this rear panel, as well as the input capacitors and the fuse. Be sure to have long enough leads attached to the units on this panel to reach the appropriate points on the main chassis when assembled. I used a cheater cord connector from an old TV set for the power cord because I dislike cords dangling from unused instruments. If you don't have one it may be omitted.

The four units are wired separately, then assembled and wired to each other. Color coding of the wires is a big help. Otherwise, care should be taken to identify each wire as it is hooked up.

No exact dimensions have been given, because I feel that in a project such as this the builder should be free to accommodate his own ideas and parts. Placement of gain controls, amplifier tubes, and crt as shown in Fig. 3, with the rear panel close behind, assures short lead where short leads are important, and the power transformer must be behind the crt. The rest of the construction can be done any way the builder chooses.

There are few critical parts. The amplifier plate load resistors are made by connecting two 8200 ohm, 2-watt carbon resistors in parallel to make the 4,000 ohm, 4-watt resistors required. The screen resistors are 27,000



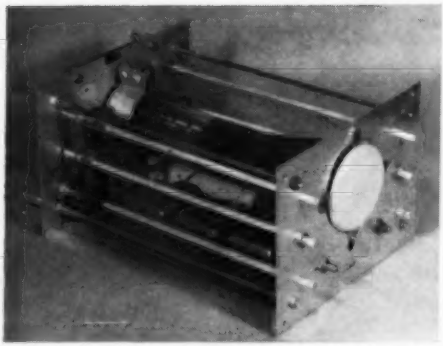
Interior view, showing rear of main chassis, general construction, placing of rectifier-filter sub chassis, and bolt extensions for rear panel.

ohm 2-watt, 20%, carbon resistors that checked close to 25k on an ohmmeter, but 25k 10-watt wirewound resistors are OK at added cost. The resistors in the bias supply were selected to give 2.1 volts bias at 1 ma. Any other combination that comes out with 2.1 volts will do as well.

The .25 mfd/1000 volt capacitor used to couple the sawtooth ripple of the voltage-doubler supply to the horizontal input (Sweep Switch) must be of very high quality. The permissible leakage is one micro amp, but even this is a bit high. Leakage resistance should be well over 1000 megohms. Too much leakage will over-bias the horizontal amplifier.

The power transformer should have two 6.3 volt heater windings, and its high voltage secondary should be good for at least 100 ma; the actual voltage can be anything from 500 to 750 volts centertapped, with 650 about right. The experimenter can change the value of the filter resistor to obtain not over 300 volts of dc for the 6CL6 plates according to whatever voltage the transformer has.

Once wired and assembled, the first test is the usual "smoke test": plug it in and see if anything overheats. (Note—the 6CL6 plate resistors normally get pretty hot.) Voltages should be checked next. They should be reasonably close to those indicated in the diagram. Be sure the voltage-doubler high voltage is NEGATIVE to the chassis. (This point bothers some builders, they are so used to high voltages being positive to chassis!) Be sure the bias voltage is right, 2.1 volts. Check the .25 mfd/1000 v sweep coupling capacitor for leakage: with the sweep switch set for 60-cy. sweep a vtvm should measure no more than −5 volts to ground from the switch side of the capacitor.



Interior view from the front, showing mounting of the crt. Note clamp for tube base, four grommets around face.

If all voltages are present and reasonably correct turn the spot switch on and advance the intensity control half way. With both gain controls turned full off and the centering controls half advanced, a spot should appear on the screen. It will be noted that the centering controls will move the spot further off center in one direction than the other, and there may be a slight interaction between the focus and intensity controls. If there is leakage in the 60-cycle sweep coupling capacitor, the horizontal gain control adjustment will have an effect on the horizontal centering. None of these irregularities affect the use of the instrument.

A simple operating test is to jumper the vertical and horizontal amplifier input connectors together and set the sweep switch to the audio position. Apply 5 or 6 volts of ac (any frequency to 10kc) from the jumpered inputs to ground. A straight line should appear on the crt face, and by various adjustments of the two gain controls this line can be made to assume any angle over a range of 90 degrees between horizontal and vertical. Try all combinations of control settings. Any curvature, especially at the ends of the line, indicates distortion, and if everything is normal the line should extend ⅞ths the width of the tube at any angle before curving. Excessive distortion indicates amplifier trouble, usually improper bias.

Note carefully the areas of the crt face where distortion is evident in this test. In any future use of the instrument these distortion areas cannot be depended upon to give a true picture of things.

By now you should be familiar with the controls. Now is a good time to level the trace by loosening the crt clamp and rotating the tube so the horizontal line formed by the 60-cycle sweep is level with the vertical gain off. The scope is now ready to use. All four inputs—vertical direct, vertical amplified, horizontal direct and horizontal amplified—are independent of each other; they can be mixed in any combination and used simultaneously if desired. Switching from direct operation to amplifier use is thus avoided in many uses.

Amplifier input (sensitivity) for full-screen deflection in this scope is 1.5 volts horizontal (rms) and one volt vertical. Full screen deflection requires about 80 volts (rms) at the horizontal direct connector, 100 volts for vertical. Frequency response of both amplifiers runs from 15 cycles to something over 4.5 megacycles within 3db. The vertical direct (rf only) input range is from about 400 kc to well over 50 megacycles. The horizontal direct input frequency range is from about 20 cps to over 50 mcs. Input sensitivity varies somewhat with the voltage on the crt, so the figures above are not absolute values.

Within the frequency and sensitivity ranges above, this instrument can be used for the usual forms of radio monitoring, and a few not so usual. For instance, with the vertical amplifier input connected to the receiver if and an rf pickup from the transmitter connected to the vertical direct input, and the 60-cycle sweep, you can watch received signals and your transmitted signal without doing any switching of the scope as you go from receive to transmit and back.

The main limit to the versatility of this instrument is that the linear sweep is only 60 cps. This is no great handicap in monitoring, and may be an advantage because it "stops" all 60- and 120-cycle ripple and hum so common in electronics and clearly identifies them. A minor limit is sensitivity, though there will be few times when it is desired to "see" voltages less than the ¼ volt (rms) that gives about the smallest usable pattern (about ½ inch) through the amplifiers.

It is beyond the scope of this article to cover the uses of this instrument, because its applications are so varied. Of course, due to simplification and corner-cutting it cannot compare with standard scopes for all-round use, but the cost of parts is moderate compared even with the kit scopes, it is an interesting building project, and the finished instrument will monitor just about any transmitter you have. I put an antenna and a tuned circuit coupled to the vertical amplifier and got a good pattern from a local BC station five miles away. (They had good modulation, too!)

. . . WØOPA

Credit for the pictures goes to Bob Rode WØBRE.

Notice to other receiver manufacturers; Read this and weep

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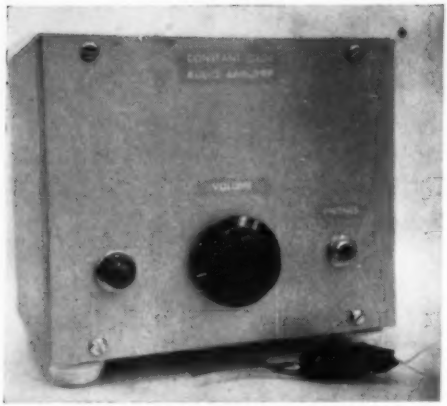


Save your ears with this interesting circuit.

Steven Pullman

Constant Gain Audio System

Do you go deaf every time a local joins a QSO you are holding with an XZ2? Is he 60 over 9 while the XZ2 is S7, or is that four way QSO keeping you riding the gain control? Here's a solution to your problem—an amplifier that will keep the audio level from shattering your eardrums while you sit back and relax.

Several months ago a company came out with a variable resistor that is controlled by low voltage dc or ac. The information that I received from them had several interesting circuits, one of which was a constant gain audio stage. I rushed out and checked the price of this variable resistor. Upon hearing that the price was $11.00, I decided to forget all about it.

This variable resistor is actually a sensitive photocell and a small light bulb sealed together. A photocell will exhibit a very high resistance across its terminals with no light striking its face, and a very low resistance when exposed to a quantity of light. I started experimenting recently, and found that an Amperex ORP63 cadmium sulphide photocell exhibited the resistance characteristics that were needed. This cell is very sensitive and with no light on the cell, it exhibits a resistance of better than 10 megohms. The ORP63 and a number 40 pilot light were taped together with black electrical tape and made light tight. Fig. 1 shows a plot of resistance of the cell versus voltage to the bulb. As can be seen, the resistance varies exponentially from better than 10 megohms to as low as 300 ohms. The total cost of this combination is approximately $1.60 as compared to the commercial device costing $11.00.

Fig. 2 shows the first circuit tried. This

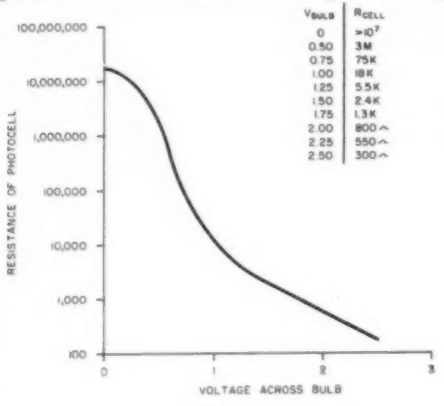


FIGURE 1

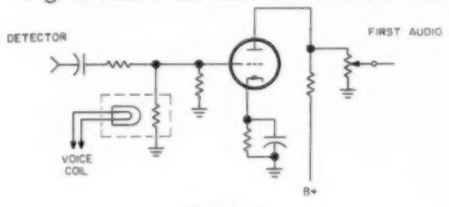
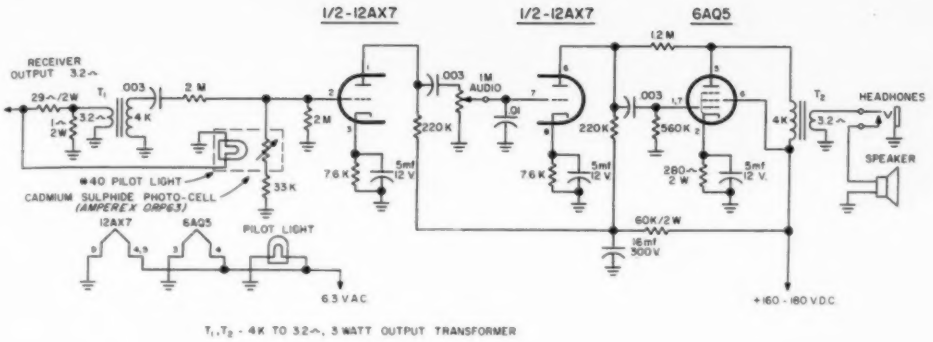


FIGURE 2



T_1, T_2 - 4K TO 3.2Ω, 3 WATT OUTPUT TRANSFORMER

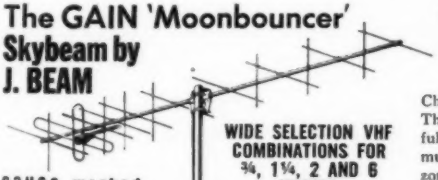
FIGURE 3

circuit works well though it necessitates modifications to the receiver and gives only one level of constant gain. Signals below that level will vary widely. After a little thought, I realized that a separate audio system would have to be used. The only modification to the receiver is the disconnection of the speaker. The circuit is shown in Fig. 3. The circuit is a standard audio amplifier except for the first stage. The first stage is controlled by the photocell-bulb combo. The number 40 bulb is connected to the input of T2. A signal is applied and the bulb's intensity varies at almost an audio rate. The decay rate of the filament provides an averaging effect. The averaging effect allows the output to vary with the amplitude rate of the signal instead of the syllabic rate of speech. The resistance of PC1 varies as the audio signal strength varies. PC1 now acts like a volume control shunting more signal to ground as the signal increases and less signal to ground as the signal decreases. This then provides a fairly constant level to the manually variable gain control R1. This constant level can be set to any higher or lower level the operator desires.

The unit is built into a $5 \times 6 \times 4$ aluminum utility case. A chassis was bent from some spare aluminum. T2 and T3 are cheap plate to voice coil transformers with a 4K primary. Standard audio layout is used. A neon bulb pilot light connected to the B plus was used; but a standard 6 volt pilot light connected to the filament may also be used. A B plus voltage of 160 to 180 volts at 30 ma is needed. This can be stolen from the receiver or from an external supply. The photocell is taped so that the sensitive face is parallel to the long side of the bulb's filament. Operation is simple. Set the receiver audio gain so that most signals are limited in gain by the first stage, V_{1A}. This can be checked by placing a VTVM across the output of V_{1A} and checking for a constant voltage as the receiver audio gain is increased. If a VTVM is not available, just listening to the output will suffice. Once the minimum signal is set by the receiver audio gain, this control is no longer used. The volume control, R1, is now used to provide any volume level needed with a fairly constant level at any setting.

. . . Pullman

The GAIN 'Moonbouncer' Skybeam by J. BEAM



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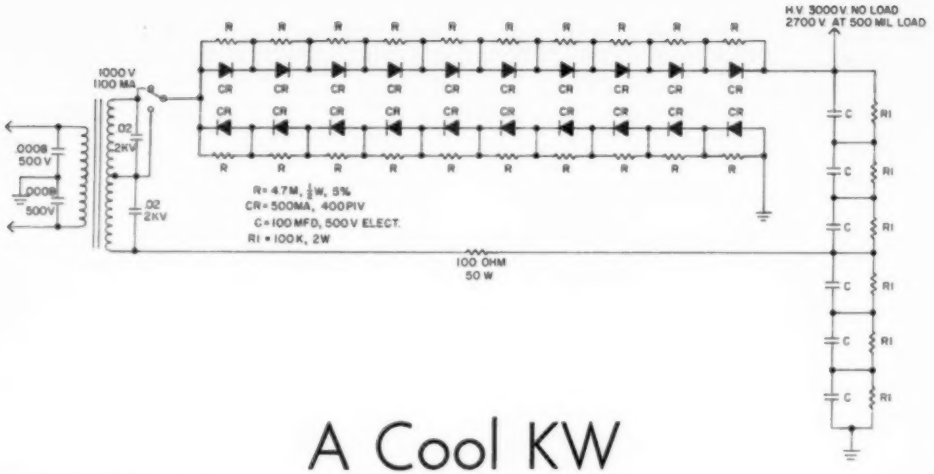

A Cool KW

Perry Thomas K5YWJ
P. O. Box 367
Silverton, Texas

Even a ham does not get "something for nothing" anymore, but this kw power supply is next to it! Compared to the cost of a conventional supply, you can have money left over for a new hat for the XYL, new shoes for the baby and cold 807's for the OM!

The transformer, about 1000 volts, at 500 ma or more, can be easily found on the surplus market. Mine is 1000 volts at 1.1 amps; Pacific Transformers #20046, from a radar power supply. Caution: do not go much above the 1000 volts across the secondary or you will end up with an embarrassingly high voltage and blown filters.

The schematic is a standard voltage doubler circuit using Silicon Diodes and high capacity filter. This shows an odd ripple pattern on a scope, but I have used it on my 813's in grounded grid ala G. E. Ham News for over two years of SSB AM and CW operating, driving it with the Apache-SB10 at first and now with the HT-37, and have had no complaints of hum. Nor have I had a single component failure in the power supply.

The diodes are Sarkes-Trazian M-500's, but 750 mil top hats are cheaper.The shunt resistors on the diodes should be 5% tolerance because they act as a constant load balance on the diodes and keep the diodes from blowing when operated at full rating.

To figure the diodes and capacitors for a transformer of different voltage, since this circuit almost triples the rms of the secondary, each leg of diodes and filter capacitors should be rated 1½ times the secondary voltage, or slightly more for a safety factor; raising the resistance of the surge resistor gives a little better regulation with a corresponding drop in output voltage. My supply delivers 3000 volts with no load and 2750 volts at 500 mil load, which is as good as most conventional supplies.

The center tap is used to give reduced power for tune-up. This really is not necessary on 813's but is an essential for some of the other tubes that may be used. I use a SPDT switch rated at 10A-250 volts here and have no trouble hot-switching it.

I hope you are as satisfied with the supply you build as I am with mine—I will never use 866's again.

. . . K5YWJ

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Hi OM!

Lots of turn over this past month and this new listing includes many new items. Remember these are fully reconditioned and guaranteed complete satisfaction. 73—Stan Burghardt WØBJV

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2m Beer Can Cavities

(Teetotalers may use soft drink cans)

The subject of resonant cavities seems to be surrounded by an air of mystery and confusion. They are things that are used by people who work UHF and microwaves and seem to have found little use in the VHF field. One reason for this is that few amateurs seem to fully understand what they are, exactly what they do, their construction, and their applications. I will attempt to simplify the subject and show what the practical applications for cavities at the VHF frequencies are.

Cavities are basically an infinite number of shorted quarter-wave tuned stubs in parallel. They take the configuration of a cylinder with a rod in the center, with one end shorted and the other end tuned by a capacitor. If you will try to forget your mental picture of expensive-looking silver-plated plumbing for a moment, try to imagine a shorted quarter wave stub. Now connect another one in parallel. Now add more until you have a circle of them so that the last one added is touching the first. You will have a can with a rod in the center, which is precisely what a cavity is. Proceeding on this assumption, and also the assumption that you don't want to spend many dollars for the silver plated variety, I will show how they can be made very inexpensively.

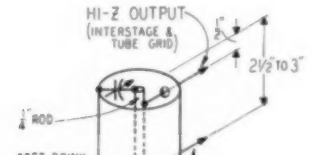

Fig. 1. Basic cavity.

The cavity has many advantages over a conventional tuned circuit. It has a very high Q and low loss. By substituting the front end tuned circuits of a converter with a cavity, the selectivity can be improved to the point that no additional selectivity is needed to eliminate images and spurious responses that are less than a megacycle from the desired frequency. Two cavities are needed, not to get a narrow enough bandwidth, but to get a wide enough bandpass to be practical. Image rejection of better than 60 db is easily obtainable for signals removed by 1 mc from a 2 mc bandpass at 2 meters. By adding one or two more cavities, rejection of better than 100 db is possible. This means that it is not necessary to use double conversion or a high *if* to get desired selectivity. With the use of cavities tuned for a 1 mc bandpass, it is possible to use the BC band *if* with few problems. This should make construction of mobile converters easier.

Cavities have a very high Q and low loss, as I mentioned earlier. Aside from the advantage of image rejection, this can noticeably improve the effective sensitivity of many low noise converters. Because of the high voltage gain, the s/n ratio of an amplifier is better. There is a fixed amount of noise at the grid of a tube. The more voltage that is applied to that grid, the more the signal will be out of the noise. The Q of a cavity effectively raises the voltage of a signal. When used to feed an amplifier, this means that a signal is amplified without the addition of any noise, as the same signal is driving the grid of the tube with more voltage compared to the tube noise, in comparison with the voltage that the same signal would deliver with a conventional tuned circuit. On a margin-

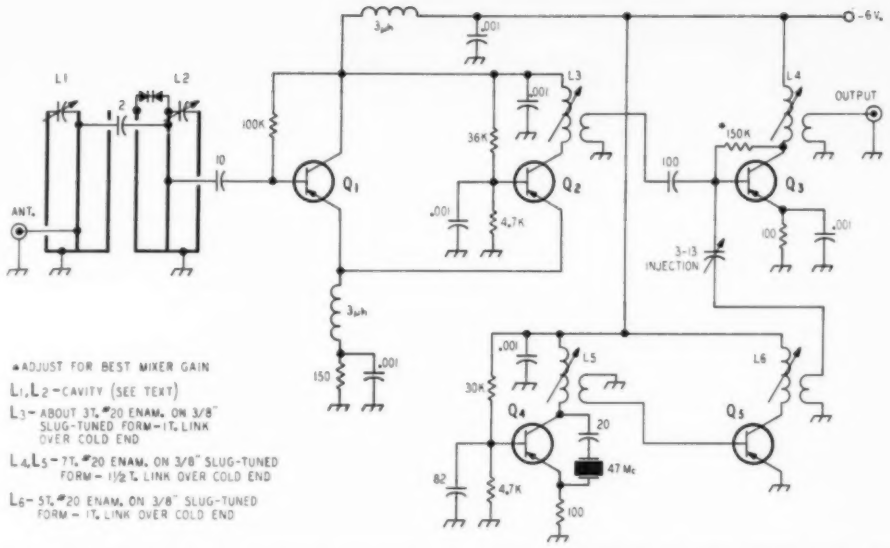

Fig. 2. Low-noise two meter transistor converter. Q1 and Q2 are 2N2360, 2N1742, 2N2495, etc. Q3, Q4 and Q5 are VHF transistors such as 2N2084, 2N1743, etc.

al signal, this means the difference between Q5 copy and no copy.

Getting back to construction of cavities, I mentioned before that a cavity is nothing more than a glorified can with a rod in the center. So why not use a can with a rod in the center? The tin plated soft drink cans (12 oz.) are just about the right size for a two meter cavity. They are easy to solder to and are easily available. The rod can be a length of copper tubing of about ⅜" or ½" diameter, available from auto supply stores. The rod is soldered to the bottom of the can in the center. Holes are drilled for the proper taps in the side of the can. The cavity is tuned with a ceramic trimmer of about 5-20 pf for the two meter version. A six meter cavity can be made by soldering two cans together after removing the bottom of one can, and tuning it with a 7-45 pf trimmer. The taps should be twice the distances given for the two meter cavity as impedance depends on distance relative to overall length. Some experimenting with the taps will produce an optimum point. Average distances are given as a starting point, and will work quite well, but each cavity should be adjusted for best s/n ratio. **Fig.** 1 shows the basic construction.

As for practical applications, **Fig.** 2 shows a transistorized two meter converter that can be built using cavity input. Transistor Q1 is an emitter follower and is used to match the impedance to the grounded base amplifier, Q2. The emitter-coupled circuit has a small amount of loss because of slight impedance mismatch, but it is low enough to be negligible, and the direct coupling makes up for some of the losses found in coupling networks. The circuit shown is capable of a sensitivity of better than .1 microvolt for a readable signal. I have not actually built the converter as shown, but have on separate occasions built both the two transistor preamp and a two meter converter using this basic design and there is no reason why the two combined shouldn't work as well or better than the separate circuits. The cavity preamp was built exactly as shown and the output is taken from point X, in case someone would like to build a preamp alone. The converter is the same as one that I built using conventional tuned circuits, except that the rf amplifier is replaced by the cavity/Q1-Q2 combination. The *if* output of 50 mc was chosen to work into a six meter converter for mobile use. With the use of cavities, the *if* could be changed to any frequency from six meters down to the broadcast band by just changing the crystal, and L4, 5, and 6 to the correct frequency. Two diodes, wired back to back are used to protect the transistors from strong signals. Any small general purpose diodes with a very low PIV will work. Don't underestimate the voltage gain of a cavity. The Q can run anywhere from 50 up into the thousands, depending upon the load-

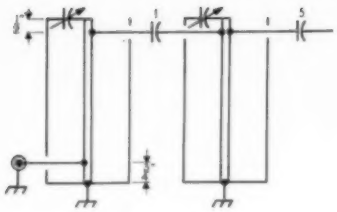

Fig. 3a. Connection for tube grid.

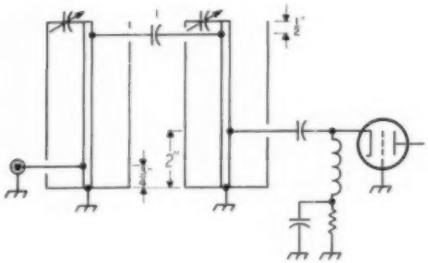

Fig. 3b. Grounded grid input.

ing. With a Q of 1000, 10 millivolts input can give up to 10 volts output, or enough to destroy the base-emitter junction of a transistor. Think about that for a second. 10 millivolts isn't much when you consider the leakage of an antenna relay at this frequency. When the diode breaks down, it loads the cavity so that the Q, and the voltage gain, drops to a very low value. This should happen before the base-emitter junction breaks down as the diodes are at a higher impedance, therefore a higher voltage point.

The loss can be reduced more by using a glass piston trimmed instead of a ceramic trimmer. Just drill a hole by the top of the cavity and mount it. A BNC connector can be mounted on the cavity for the input, if desired. By connecting a 5-50 pf trimmer to point Y, it may be possible to obtain a better match. This will have to be determined experimentally for each cavity.

Fig. 3 shows how the cavities are used for tube circuits. **Fig. 3a** is for a grounded cathode or cascode amplifier. **Fig. 3b** is for a grounded grid. I think that the best advantage of the cavities is in the front end of a cascode, as most advantage can be taken of the voltage gain. The difference is slight, however, if care is taken to match impedances carefully and reduce loading.

The cavities for any of these circuits are bandpass tuned for the desired portion of the band. It is possible to stretch about 2 mc at two meters by careful adjustment. They are bandpassed by conventional tuning procedures. The tuning is quite critical, however, and must be done more carefully, as a small fraction of a degree of rotation can detune the cavity a considerable amount, so proceed slowly. The piston trimmers have the advantage of finer control.

The physical mounting of the cavities are easily accomplished by the use of small copper straps. The outside of the can is cold for rf and can be grounded at almost any point or points. The simplest way is to mount the can on its side and strap it to the chassis at both ends, making doubly sure to make good contact. Mounted this way, they take up little space.

I hope that I have cleared up some of the mystery of cavities for you. It would be nice to see more hams taking advantage of the benefits of cavities, and saving money by not having to buy that gold-plated converter that you were going to mortgage the shack to buy, in order to gain ½ db. Spend the money on a better beam instead, and improve your transmitted signal, and you will be better off. Get out your can opener and good luck.

. . . WA2INM/1

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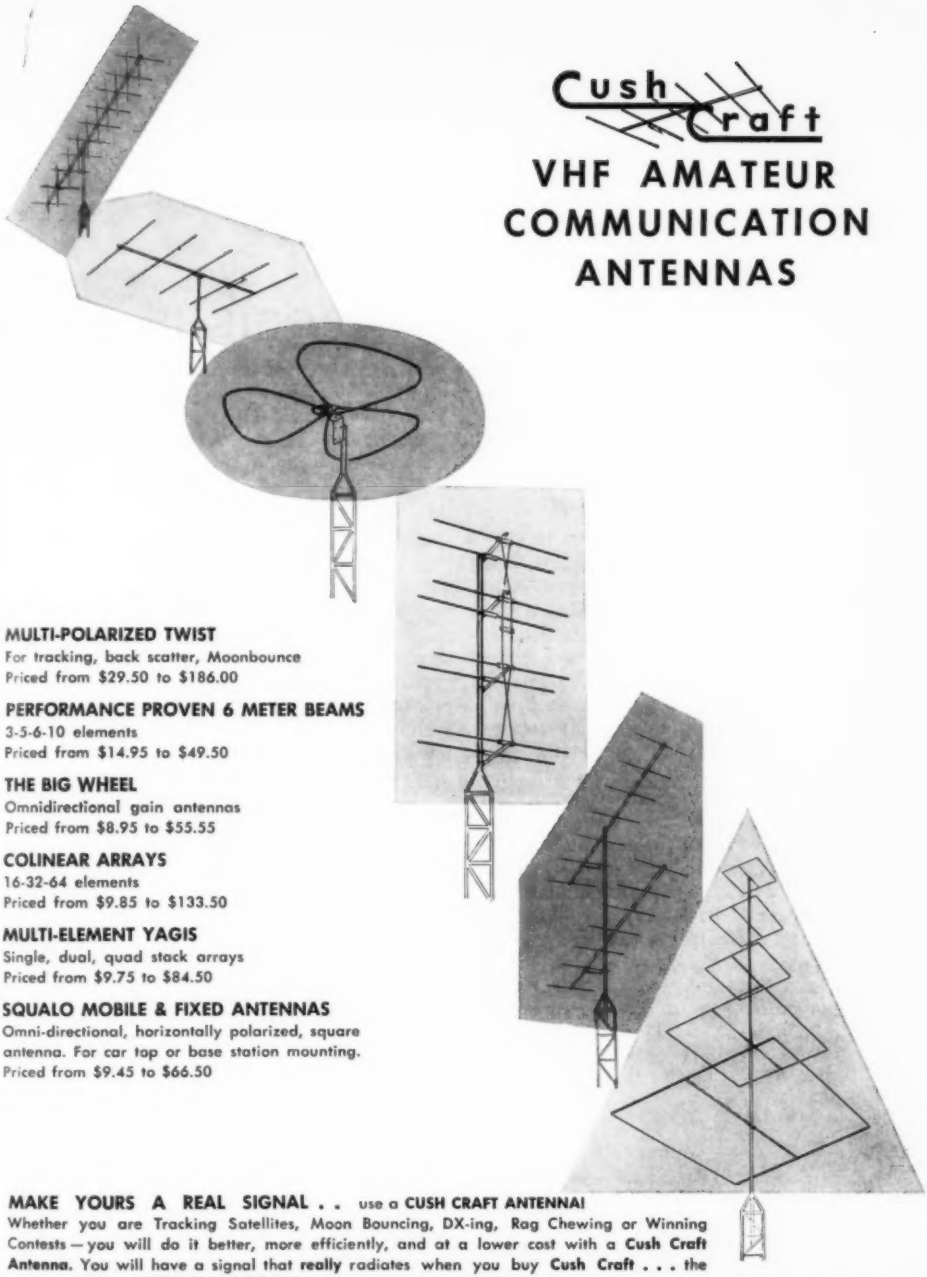

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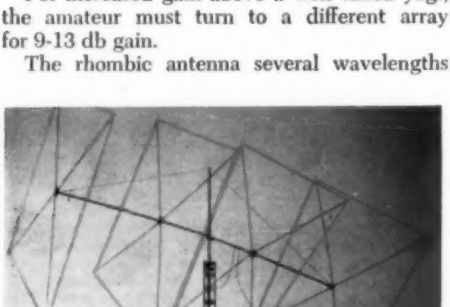
The 4-element Rhombus

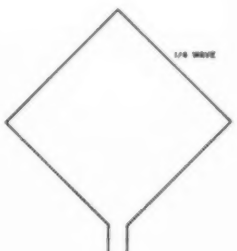
An antenna's gain is determined primarily by its configuration. For example, a two element parasitic beam characteristically exhibits about a 4-5 db gain over the usual dipole standard. It will give only 4-5 db, and no alteration to the feed point or spacing will materially increase the gain. A third element properly spaced will add some gain. However, diminishing returns reduce the amount of gain to a smaller percentage than when the second element was added to the driven dipole. Consequently, a practical point is reached where the yagi array supplies the greatest benefit, and further element additions produce an extremely cumbersome system without corresponding increase in gain. The normal yagi is therefore 3-4 elements on a 16-20' boom with a gain of about 5-8 db.

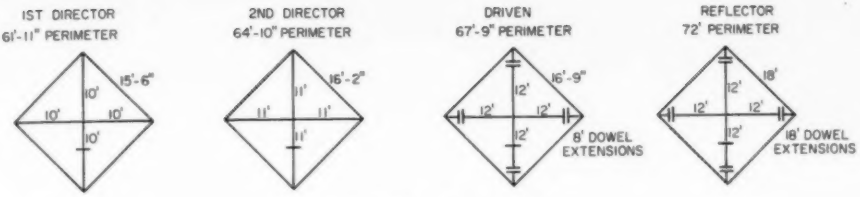
For increased gain above a well tuned yagi, the amateur must turn to a different array for 9-13 db gain.

The rhombic antenna several wavelengths long is acknowledged to be a desirable antenna. It has superior radiation and gain qualities. With this in mind, it was decided that a rhombus (one wavelength in periphery) in a vertical plane coupled parasitically to three similar units properly spaced and tuned would produce an outstanding signal. The large area within the closed loop intercepts a greater portion of the radiated magnetic field thereby sampling more signal. Since the antenna's receiving quality is directly proportional to the gain, it follows that the antenna will radiate a great amount of rf energy. For the low vertical angle of radiation, the feed point remains at the lower apex of the rhombic. The normal resistive terminations are deleted. Since the maximum field of radiation is perpendicular



4-element rhombus.





Dimensions of rhombus.

to the plane of the array with insignificant minor lobes, it is ideally suited to the rotatable installation. On the air tests have shown the front-to-side ratio to be 30-40 db.

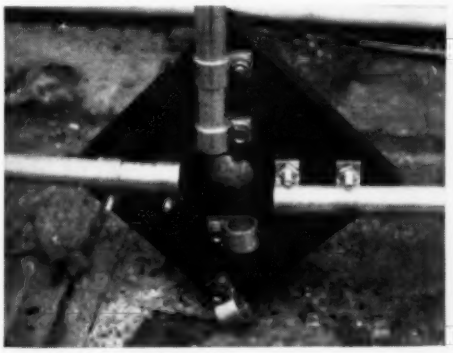
The entire unit is home-brew and utilizes aluminum spreaders for strength and durability with no detectable sacrifice to antenna input characteristics. Contrary to popular belief, signals were not spuriously radiated or absorbed due to the aluminum cross arms. Tests were made by a local amateur (WA2KQZ) residing several blocks away for harmonic indications (within the range of a 75A4 receiver) and none were detected. The antenna reflected zero reactance when coupled to various measuring devices and exhibited a near perfect resistive termination. Since maximum signal transfer was of prime importance, the unit was designed for one band only. Compromise SWR was not to be tolerated since no multiband antenna performs as well as an antenna designed for one-band operation.

Construction

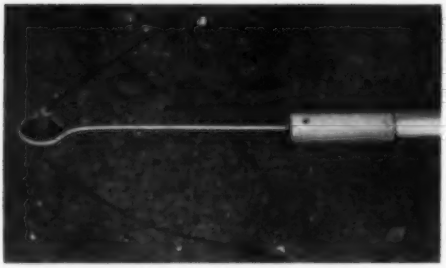
A boom length of 30′ worked well and netted a spacing of 10′; however, 8′ between elements will exhibit properties of similar value with a somewhat lower input impedance and gain factor. Should a perfect 50 ohm terminus outweight the desire for maximum gain, driven element spacing with respect to the reflector element could be attempted. Anticipate a lower gain but receive a better transmission line-antenna match with the smaller spacing due to the closer parasitic element coupling affects.

The spider units were built around four 12×12″ squares of ¾″ plywood preserved in creosote solution. Four aluminum 1¼″ pipe flanges with set screws provided spider-boom securement. Holes equal in diameter to the flange openings were drilled in two spider units to facilitate placement on the boom. Eight tubing clamps were positioned on each plywood square so that the aluminum spreaders would be properly oriented and perpendicular to each other. A 12′ length of ⅞″ tubing 0.058″ wall was chosen for each upper mast vertical spreader support since the greatest stress was upon this unit. A 6′ length of ⅞″ tubing was chosen for the lower vertical portion. An additional 6′ length of ⅞″ tubing 0.058″ wall was telescoped several inches into the larger unit for ease of construction. The two horizontal and one vertical (upper) portion of the four systems were assembled at roof level and then raised to 6′ with the tower or supporting structure. While still within arm's reach, the 6′ length of ⅞″ tubing was installed into each spider unit and secured. The antenna was then raised another 6′ and the length of ⅞″ tubing installed by telescoping into the larger unit. A 1″ hose clamp completed the mechanical bond. This telescoping flexibility will be particularly welcomed by those with no tilt-over tower of long extension ladder facilities.

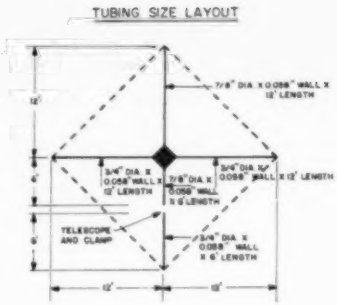
In order to insulate the #14 formvar coated copper wire from the aluminum, dowels were cut, boiled in paraffin to increase their insulating quality, and installed into each spreader end. The ⅞″ and ¾″ tubing requires ¾″ and ⅝″ dowel respectively. Screw-in TV type insulators were installed in each dowel which not only provided isolation but assisted



Details of center support.



Detail of spreader.


TUBING SIZE LAYOUT
12'
7/8" DIA X 0.058" WALL X 12' LENGTH
4'
3/4" DIA X 0.058" WALL X 12' LENGTH
7/8" DIA X 0.058" WALL X 6' LENGTH
3/4" DIA X 0.058" WALL X 12' LENGTH
6'
TELESCOPE AND CLAMP
3/4" DIA X 0.058" WALL X 6' LENGTH
12'
12'

in subsequent adjustments of spreader breadth. Where the formvar wire passed through the standoffs, a length of polystyrene 8U insulator was slipped over the wire. The inner conductor insulator not only provided additional isolation, but tended to soften the corner angles thereby reducing radiation loss due to the otherwise sharp bend angles. After final adjustment, each standoff was squeezed closed with a plier and further movement was prevented.

Rather than measure each rhombus leg individually, four separate lengths of twine were cut which corresponded to one side of the four antenna elements. This aided immeasurably when leg lengths were being determined. One end of the twine was placed at the uppermost vertical support and the other end swung in a pendulum-like motion. Each leg was adjusted and pulled taut using the premeasured string as the reference. Error was kept to a minimum. The screw-in standoffs were adjusted slightly to provide the proper length and tension and insured a true geometric figure. Balance was the key to the proper design and careful attention was given to the symmetry of the array.

The rhombus is a balanced system electrically and the transmission line should also boast balanced properties; however, coaxial cable, inherently unbalanced and not ideally suited to this installation, was used with no negligible loss. Simply solder the center conductor and shield to the two antenna wire terminations at the lower apex angle and coat the connections with liquid polystyrene. Dampness will have less effect on the loading.

The antenna reflected about 60-65 ohms when at roof level and varied slightly when raised to the operating height. This tended to indicate that the array was suitable to installations where height cannot be easily attained. Many apartment house and limited space dwellers could easily rotate the system several feet above the roof level with little sacrifice to radiation input characteristics; however, for the low angle of radiation and maximum signal projection a height of 60' and more is necessary. Although polarization shifts when reflected from the ionized layers, the initial low vertical angle of radiation provides the slight edge over the standard horizontally polarized quad array of comparable design. For line-of-sight transmissions (to a horizontal array) cancellation affects due to cross polarization are evident, but the DX signal losses are infinitesimal and are of no concern.

The dimensions given are to resonate the antenna system at the 14.270 MC mark. For operation in the CW portion of the spectrum, add one foot to the perimeter thereby lowering the resonant frequency. Insure that equal increments are also added to the other elements to maintain inductive and capacitance reactance balances. The "Q" or bandwidth of the system is reasonably low and will allow for operation over the entire amateur portion of 20 meters, but losses can be expected with major movements away from the resonant frequency. An SWR bridge will indicate the tolerances within which one's transmitter will properly perform.

. . . K2IRK

Parts List

6 12' lengths 7/8" 0.058" wall tubing
10 12' lengths 3/4" 0.058" wall tubing
4 1¼" pipe flanges (aluminum)
16 7/8" aluminum clamps
16 3/4" aluminum clamps
4 12 x 12" 3/4" plywood (creosote soaked)
4 spools #14 magnet wire (heavy formvar insulation)
16 7" standoff insulators (screw-in)
4 length of 3/4" dowel
12 Lengths of 5/8" dowel
4 aircraft hose clamps 3/4"
32 ¼ x 3" bolts
32 ¼" nuts
32 lock washers

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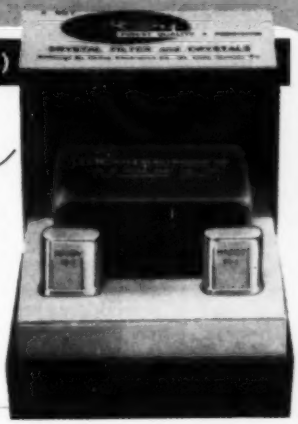
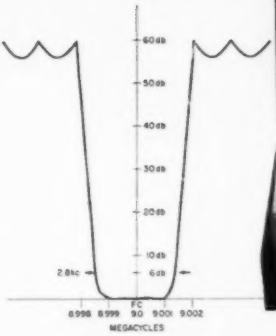
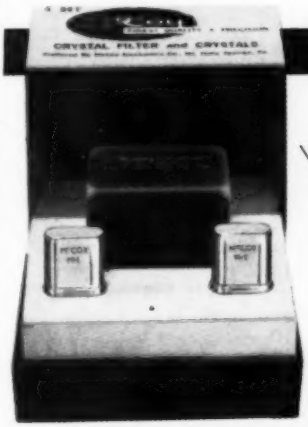
The GOLDEN GUARDIAN (48B1)

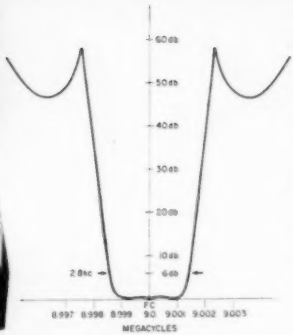


TECHNICAL DATA
Impedance: 640 Ohms in and out (unbalanced to ground)
Unwanted Side Band Rejection: Greater than 55db
Passband Ripple: ± .5db
Shape factor: 6 to 20db 1.15 to 1
Shape factor: 6 to 50db 1.44 to 1
Package Size: 2 7/16" x 1 19/32" x 1"
Price: $42.95 Each



The SILVER SENTINEL (32B1)





TECHNICAL DATA
Impedance: 560 Ohms in and out
Unwanted Side Band Rejection: Greater than 40db
Passband Ripple: ± .5db
Shape factor: 6 to 20db 1.21 to 1
Shape factor: 6 to 50db 1.56 to 1
Package Size: 1¾" x 1¼" x 1"
Price: $32.95 Each

Both the Golden Guardian and the Silver Sentinel contain a precision McCoy filter and two of the famous M-1 McCoy Oscillator crystals. By switching crystals either upper or lower side band operation may be selected. Balanced modulator circuit will be supplied upon request.

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A Power Decade Resistor

As most technicians and hams are all too well aware, the average resistor decade or substitution box is only rated for a few watts power dissipation at most. Usually the place where one needs the adjustable feature of the decade box the most is just the application where the power rating of the device is vastly exceeded. This was brought to my attention one day when a fellow student cooked a General Radio decade resistor while adjusting a voltage divider in a laboratory experiment at school. I decided that I needed a power decade resistor, and since these are rare and quite expensive, I decided to homebrew it.

One of the most common methods of constructing decade resistors is to use resistances of 1, 2, 3 and 4. With these four values, one can obtain any value between 1 and 10. Usually a special rotary switch such as that made by Mallory (or a special connection of a standard 11 position double pole rotary switch) is used to select the desired resistances. Rotary switches, however, are not too well suited for power application, because of their limited current carrying capacity. Therefore the simple circuit in Fig. 1 using toggle switches was put together.

Note that the resistors are all in series, in the natural order 1, 2, 3, 4 and that each resistor has a SPST toggle switch in parallel with it. With all the switches closed, the resistance is zero; to put a particular resistance in the circuit, one merely opens the switch in parallel with that resistor. The desired value of resistance is made up by adding the various values up until the desired total is reached. It should be remembered that in a series network, the voltage across (and therefore the power dissipated by) any particular resistor is proportional to its resistance. If you have a 10 ohm and a 20 ohm resistor, each rated at 10 watts, in series and try to dissipate 20 watts in the combination, you will find that you are actually dissipating 13.3 watts in the 20 ohm resistor and 6.7 watts in the 10 ohm resistor. Obviously the 20 ohm resistor is overloaded. The use of toggle switches solves the problem of the switch contact current rating, and makes the wiring of the unit simple as well. The cost of the unit using toggle switches is cheaper than that of the unit using rotary switches.

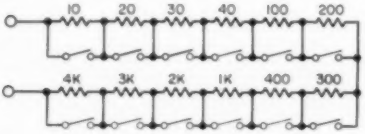

Fig. 1. Schematic diagram of power decade resistor.

A decade box using three decades and adjustable from 10 ohms to 11,100 ohms in 10 ohm steps was constructed in a standard 5 × 10 × 3 aluminum chassis. The units which I made all used 10 watt resistors, but there is no reason why one cannot use any size desired. If you use 10 watt resistors, the cheapest seem to be the PW series made by IRC. While these have a nominal tolerance of 10%, I have found very few that are off more than 5%. For short term use it was not found necessary to drill ventilation holes in the chassis. If hard use of the box was foreseen, or if it were constructed for a higher wattage rating, then ventilation would be a must. This method is also useful for making standard resistance decades using precision resistors, but it is often cheaper to buy these ready made, unless you have a supply of precision resistors of the proper values. A similar method may be used to make a capacitor decade box, by placing all the capacitors in parallel, and putting the switches in series with the capacitors. In this layout, the switch is closed to select a particular capacitor.

. . . Lyman

Lee I. Meyerson
WØGFQ

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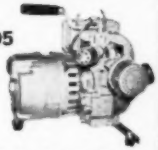

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Improving The Grid Dip Meter

One of the most useful items in any ham shack is a grid-dip oscillator, usually called either a grid-dip meter or simply a dipper.

Many versions of this handy little device are available in either kit or ready-wired form; all work well, some better than others. However, many of the less expensive ones share one common disadvantage—difficulty in keeping the meter needle on-scale at the lower frequencies.

This comes about because the oscillator must be extremely active to get any kind of meter indication at the UHF end of the range, which results in so much grid current at the lower frequencies that the "sensitivity" control's effect is greatly magnified.

In my dipper, the result was almost complete inability to keep the needle on-scale when using either the A, B, C, or D coils. It was even a problem with the 42-100 mc coil; the only place I didn't have this trouble was on the 100-200 mc band!

However, for 15 cents and a few minutes' time, the problem can be completely removed. The modified dipper can give an off-scale reading still, but the "sensitivity" control moves it smoothly back to the top of the dial. All who have used it agree that the modification is well worth the effort—which is actually so small as to make that statement a sort of left-handed compliment!

Though the description which follows applies specifically to my dipper, the modification is applicable to any GDO whose meter circuit resembles Fig. 1.

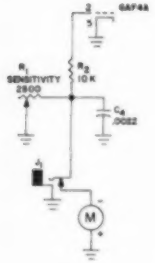

FIG. 1 ORIGINAL CIRCUIT

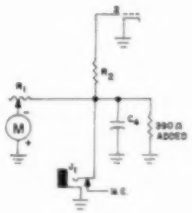

FIG. 2 MODIFIED CIRCUIT

A glance shows the reason for the difficulty. The meter itself is a 500 microamp movement, connected through the phone jack from the bottom of the grid-leak to ground. The "sensitivity" control is simply a variable shunt for the meter. When grid current is 500 microamps or less, the sensitivity control is turned to its full-resistance position and effectively is out of the circuit. But when grid current is higher than this, the 2500 ohm pot must be cranked down to shunt the meter.

The amount of shunt resistance required on the lower ranges is somewhere near 100 ohms in most cases; trying to set a 2500 ohm pot to 100 ohms with any degree of accuracy is almost impossible, since the resistance of the pot changes some 8 ohms for each *degree* of movement, and the hand is unable to move the knob much less than 5 or 10 degrees at a time. The result is the familiar inability to set the needle; the meter jumps from zero to off-scale with almost imperceptible movement of the control.

However, if the arm of the pot is lifted from ground and connected to the negative meter terminal, breaking the connection from the meter to the phone jack in the process, and a low-value resistor is added from the top of the pot to ground as shown in Fig. 2, the circuit becomes somewhat different.

Now the grid current develops a voltage across the new resistor, and the pot-meter combination becomes a variable-scale voltmeter. Sensitivity of the voltmeter varies directly with pot movement.

My dipper develops a maximum of about 2½ ma of grid current on its lowest band. The combination of the 500 microamp meter and the 2500 ohm pot forms a voltmeter which reads full-scale with 1.25 volts input, if the pot is set for maximum resistance. These voltage and current values, in turn, prescribe the maximum value for our added resistor. To

just be capable of full-scale readings, the added resistor cannot exceed 500 ohms in value.

To leave some margin for tube aging, etc., I chose to use a 390 ohm resistor. This will allow a reading of 390 microamps on the meter if the pot is set for maximum resistance, and this will be the *lowest* reading you can get at this point with the modified meter. Reducing the pot resistance to 1,950 ohms gives you an exact full-scale reading.

On the UHF bands, turning the pot to minimum resistance will effectively remove it from the circuit, leaving you simply the 500 microamp meter shunted by a 390 ohm resistor. While 390 ohms is a whale of a lot less than 2500 ohms, the effect turned out to be negligible here; readings were reduced less than 5 scale divisions on the meter, and it was still a cinch to read the unit.

If you'd like to make a second modification while you have the case off, here's one which has nothing at all to do with the operating convenience but can help protect your meter movement if you carry the instrument around a lot.

This change involves replacing the SPST "power" slide switch with a DPDT switch of similar construction and size, and using the added pole to short out the meter when the power is off.

Any D'Arsonval movement will tend to "kick around" quite a bit with vibration, and a sensitive meter such as used in this unit is especially subject to getting knocked off its bearings by any extreme shock.

However, if the meter terminals are shorted together, the movement of the needle with vibration is almost completely damped out. This comes about because if the needle moves, the coil in the meter generates a small voltage (it's just a small generator in reverse). When the terminals are shorted, this voltage is immediately applied back to the meter, freezing it in position at zero.

The change is as simple as the previous one: Remove case, take out power switch, and disconnect both wires. Connect them to new DPDT switch, using corresponding terminals. Connect two new wires to the other pole of the switch, using the terminals toward the opposite end of the switch. Reinstall switch, and connect one of the new wires to each terminal of the meter. To check for proper wiring, turn power switch "off" and shake meter. If needle moves, check your connections—it shouldn't budge a fraction. If it stays put, slide switch to "on" and shake gently again. Meter should now gyrate wildly.

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Superb DX performance. Features wide spaced elements on a 24 ft. boom. New Hy-Q Traps provide true full-sized performance. Feeds with 52 ohm coax – Beta Matched for optimum gain – maximum F/B ratio without compromise. SWR less than 1.5:1 on all bands. Longest element, 32 ft. – weight, 47 lbs. Model TH6DX, **$139.95** Net.

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Compact...installs almost anywhere... delivers excellent performance. Features new Hy-Q Traps. Feeds with 52 ohm coax – Beta Matched for maximum gain. Rugged lightweight construction compatible to rotating with standard TV rotator. Boom length, 6 ft. Longest element, 26 ft. Weight, 21 lbs. Model TH2Mk2, **$69.95** Net.

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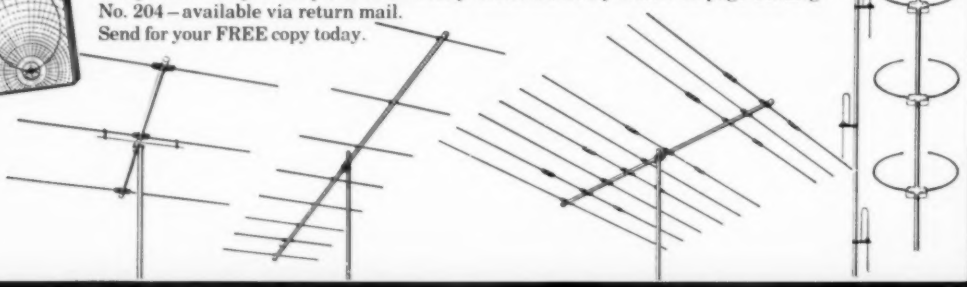

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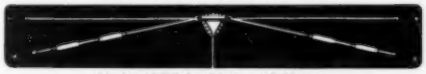
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Model 2BDQ for 40 and 80 Meters

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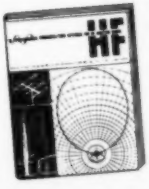

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Phone 886-5749

BOX 37A WATERTOWN, SOUTH DAKOTA

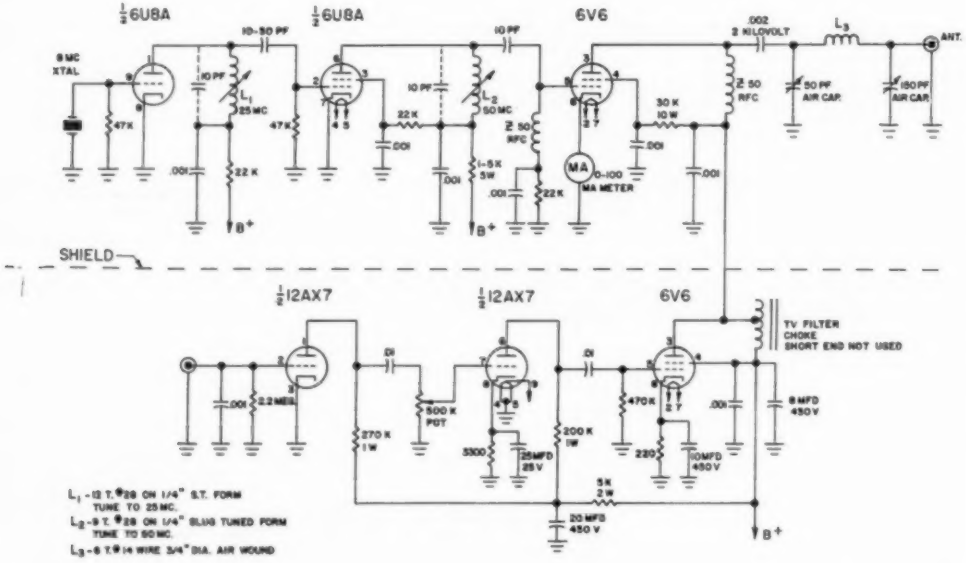
L. J. Hemmis K3VLQ
2227 Eastern Ave.
Wesleyville, Erie, Pa.

One More 6 Meter Junk Box Rig

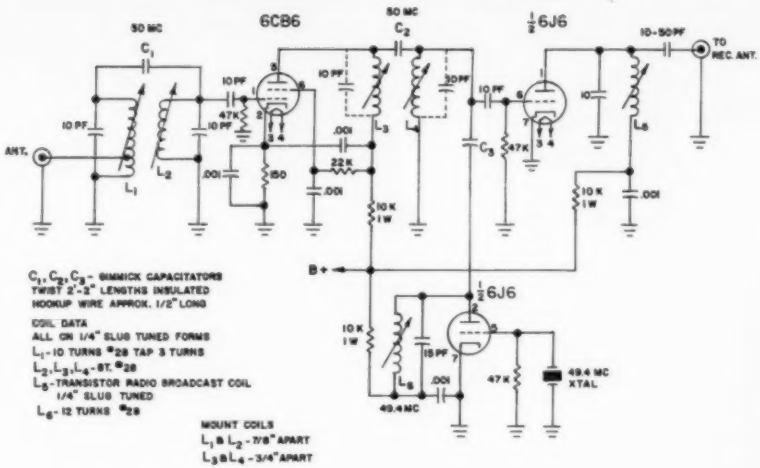
Perhaps my junk-box is better stocked than some (most of my parts come from junked TV sets and 6 volt auto radios), but this little rig required a cash outlay of under seven dollars for the missing parts. With a little trading I might have cut it down further. The biggest outlay was $4.50 for the crystal for the receiver converter. The west coast boys are a little more fortunate with their plentiful supply of military surplus gear, but we make do with old TV sets.

The transmitter could be called a "Glorified Sixer", running about 18 watts input into a 6V6. This tube was chosen as a final because most car radios from the junk yards happen to have two of them in the line-up. The 6U8 oscillator and doubler came from a TV set, as did the 12AX7, the slug-tuned coil forms, sockets, resistors, condensers, and the modulation transformer. A word about the transformer—in the original version of this rig, I tried a push-pull audio transformer as described in several schematics, and had my share of troubles trying to get enough audio to modulate the rig. I finally used the filter choke from a TV set and now have audio gain to spare.

Lay out your parts so that all leads can be kept as short as possible. Another point: isolate the modulator section from the oscillator and final. The rule is "shield until it hurts." This complete rig, less power supply, was built in a box 5x7x6 inches high, starting on a 2x5x7 inch chassis. The modulator was kept away on one end of the chassis, and the underside has an aluminum shield 2x5 inches separating the modulator wiring and sockets from the oscillator and final. If good construction practices are observed you shouldn't have any difficulty.



6 METER CONVERTER TO BROADCAST BAND RECEIVER



It is a good idea to check all the slug-tuned coils with a grid-dip meter to get them somewhere near frequency before they are installed in the chassis. Give them another check and adjustment after the wiring is completed and tubes are in the sockets, with the *power off*. If you don't have a GDO, you probably know a ham friend who will be more than glad to give you a hand.

The receiver is a 6 volt auto radio, converted to 110 ac operation, with a converter in front of it. The conversion to ac is simple—pull the vibrator out and discard it. Now you have a choice. You can either retain the power transformer in the set, and feed *one half* of the primary winding with 6 volts ac (if you are using a 6 volt set) at about 5 or 6 amperes. An old train transformer will work here, if it has the current capabilities. Another source is the 6 volt winding from a TV power transformer. If you have the schematic of the set, you're in business. If not, locate the primary windings which go to the vibrator socket, usually the two small pins, or to one pin and chassis. That's where you feed the 6 vac, and the set should work. Your second choice involves more work—discarding the original transformer as well as the vibrator, and building a complete power supply to feed both filaments and high voltage demands of the set. In either case, a realignment of the receiver after conversion is worthwhile.

The 6 meter converter is an accumulation of ideas, not necessarily original nor the best available, but also "cheap and it works." As is the case of the transmitter, most of the parts, including tubes, came from a junked TV set. Plenty of shielding was used between stages. My converter is housed in a 2x4x4 aluminum utility box, which doesn't leave much room to spare. A better size, to give you a little more working room, would be a 2x4x6 inch box. Coils were also tuned somewhere near frequency before they were installed in the chassis, and touched up after the final wiring and tubes were in place.

With the *if* frequency shown, your car radio will tune from 50 to 51 megacycles, which is the most popular part of the band in this locality.

If meters are a problem, just about any sort of a meter movement can be converted to 0-100 ma tuning meter for the transmitter with a proper shunt. All you're looking for is an indication, not a measurement, for loading the transmitter, and you can pick up a movement from an old tube tester, or something similar for next to nothing.

We have never worked Japan on this rig, but it does provide good communication within a 100 mile radius of the QTH, and that's all that was expected of the 6 meter band. After spending quite a few hours listening on six, it is my considered opinion that high power, and that covers anything over 50 watts input, is a waste on this particular band. This rig fills the bill. See you on six meters.

. . . K3VLQ

Waters

AMATEUR

RADIO

EQUIPMENT

"Convenience Engineered"

Waters amateur radio equipment is "Convenience Engineered" to make correct operating practices easier while assuring superior performance. The Waters trademark is a guarantee of the finest that advanced engineering skill and sound manufacturing principles can produce.

Bob Waters—W1PRI

Waters TEST EQUIPMENT

Good clean signals and maximum efficiency are usually the result of proper adjustment using reliable test equipment. Waters Test Equipment provides the means to get the most out of your equipment.

WATERS
DUMMY LOAD/WATTMETER — Model 334

The Dummy Load/Wattmeter is an RF power absorption device and an RF wattmeter for making non-radiating performance tests on radio transmitters.

It combines a structured monolithic 52 ohm load and an integral direct reading RF wattmeter. The load is contained in an hermetically sealed liquid dielectric-filled container providing RF shielding and cooling. It is rated for continuous operation at 50 watts and intermittent use to 1,000 watts over a frequency range of 2 to 230 megacycles. A thermostatically operated warning light indicates when the maximum safe-operating temperature is reached.

DUMMY LOAD/WATTMETER SPECIFICATIONS: Frequency Range: 2 to 230 mc. **Load:** Non-inductive, oil cooled. **Load Impedance:** 52 ohms. **VSWR:** Less than 1.3:1 up to 230 mc. **Power Range:** 50 watts continuous; 1,000 watts intermittent. (Maximum inner case temperature of 220 F is reached in 5 to 7 minutes at 1,000 watts input. Warning light signals at this point.) **Wattmeter Range:** 3 calibrated scales: 0-10 w; 0-100 w; 0-1,000 w. **Accuracy:** 2-30 mc, ± 5% of full scale; 30-150 mc, ±10% of full scale; 150-230 mc, ± 20% of full scale. **Input Connector:** Hermetically sealed SO-239 UHF, mates with JAN standard PL-259 (Amphenol 83-1SP). **Size:** 4 ¾" x 9" x 10¼" **Weight:** 12 lb. **Price:** $89.95

WATERS
REFLECTOMETER—Model 369

The new Waters REFLECTOMETER is a dual indicator voltage standing wave ratio MEASURING instrument. BOTH the forward and reflected voltages expressed in RF watts are shown at the same time on the unique double meter. Unlike conventional VSWR indicators, the REFLECTOMETER has multiple scales that provide 5 & 10 to 1 increase in sensitivity of Reflected Power, permitting very accurate readings of low reverse power values.

The REFLECTOMETER Indicator is housed separately from its Directional Coupler which may be located remotely in the coaxial line and connected with shielded cable.

REFLECTOMETER SPECIFICATIONS: Scales Forward: 1,000 watts; 200 watts. **Scales Reflected:** 200 watts; 20 watts.

Impedance: 52 ohms. **Frequency Range:** 3 to 30 megacycles. **Accuracy:** (Power) ± 10% of full scale (in 52 ohms). **Power Loss:** Negligible. **Size:** Indicator — 5 ½" x 3 ¾" x 4 ¼"; Directional Coupler—4" x 2" x 2 7/16". **Weight:** Indicator—1½ lb; Coupler—¾ lb. **Price and Availability:** To be announced.

WATERS
WIDE RANGE ATTENUATOR—Model 371 & Model 372

The new WIDE RANGE ATTENUATOR is an accessory device designed to provide stepped attenuation of signals in receivers, signal generators and other low-level radio frequency equipment (converters, etc.). The WIDE RANGE ATTENUATOR installs in the coaxial line using either UHF or BNC connectors. Attenuation steps are selected with rocker-type switches marked in decibels. There is NO insertion loss with switches in OUT position.

ATTENUATOR SPECIFICATIONS: Power Level: ¼ watt maximum. **VSWR:** 1.3 maximum DC to 225 mc. **Impedance:** 50 ohms, nominal. **Attenuation Range:** 0-61 db in 1 db steps. **Attenuation Accuracy:** .1 db/db DC-60 mc; .1 db/db ± .5 db DC-150 mc; .1 db/db ± 1.0 db DC-225 mc. (Model 371-1 with SO239 UHF connectors. Model 371-2 with BNC UG-1094/U connectors. **Price and Availability:** To be announced

WATERS "LITTLE DIPPER" ®
TRANSISTORIZED RADIO FREQUENCY
DIP OSCILLATOR — Model 331

The "LITTLE DIPPER" is a fully transistorized RF dip oscillator which performs all functions of a grid dip oscillator, an absorption wave meter and a signal generator for field use with its built-in audio modulation.

The "Little Dipper" consists of: 1) a stabilized MADT transistor RF oscillator covering the frequency range of 2 to 230 mc in 7 overlapping plug-in coil ranges. Each coil carries its own linear calibrated frequency scale. 2) Transistorized 1,000 cycle audio oscillator for modulation. 3) Transistorized DC amplifier and meter for detecting the dip.

"LITTLE DIPPER" SPECIFICATIONS: Frequency Ranges: 2-4 mc, 4-8 mc, 8-16 mc, 16-32 mc, 32-64 mc, 50-110 mc, 100-230 mc. **Accuracy:** ± 3% (full scale value). **Modulation Frequency:** 1,000 cps nominal. **Battery Life:** 300 hours. **Power:** Four AA penlight batteries. **Size:** 7" x 2¼" x 2½" **Weight:** 1 lb. 6 oz. **Case:** Stainless steel. **Price:** $129.75

WATERS MANUFACTURING INC. WAYLAND, MASSACHUSETTS

Waters NEW AUTO-MATCH™

The Stronger Mobile Antenna

Combining stronger structural strength with stronger signal strength Waters new AUTO-MATCH Mobile Antenna is setting new high standards in the mobile operating field! AUTO-MATCH operates with only a coil-change on every ham band to provide more signal strength with its greater radiation efficiency. The tapered radiator tip is of drawn 17-7 PH stainless steel and adjusts to all frequencies. Interchangeable Top-Center loading coils are molded in low-loss Epoxy and are completely sealed against moisture and water seepage. High Q stable inductance handles 500 watts of RF and at resonance presents an "Auto-Match" of 50 ohms. The lower mast is of aircraft aluminum tubing upper mast of solid tapered-drawn aluminum rod. Pull-up foldover hinge drops AUTO-MATCH to car-top level and AUTO-MATCH fits any standard base or bumper mount. AUTO-MATCH is rugged, very rugged — designed to last for car after car, rig after rig.

PRICES

MAST 370-1	$12.95	COIL 370-20	$13.45
RADIATOR TIP 370-2	$ 9.95	COIL 370-15	$12.75
COIL 370-75	$15.95	COIL 370-11	$11.95
COIL 370-40	$14.95	COIL 370-10	$11.95

Waters CODAX™

Automatic Keyer

MODEL 361

Waters CODAX Automatic Keyer makes "smoothest-ever" CW operating possible with automatic spacing and timing for any speed from 5 to 50 WPM. A built-in double-paddle key (one for dots and one for dashes) adjusts to accommodate any fist ... and CODAX won't walk at high speed transmissions. CODAX has solid state digital circuitry and an hermetically sealed "Reed" relay for lasting reliability. The keyed 1500 cycle audio output is at microphone level permitting use of the VOX circuit on either upper or lower sideband. CODAX permits self-monitoring and interconnects with any transmitter, transceiver or receiver (keying the grid block circuit or operating keying relay in AM/CW rigs). CODAX is self-powered.

CODAX SPECIFICATIONS: Speed Range: 5 to 50 WPM, variable. **Dot-Dash Ratio:** Fixed 3-to-1. **Space-to-Character Ratio:** Fixed 1-to-1. **Controls:** Audio output level/On-Off switch; Speed control. **Semiconductors:** 10 transistors; 14 diodes. **Outputs:** #1 Cable—Relay contacts rated at 15 watts total power; 250 volts DC maximum and 1 ampere maximum. (Volts x Amperes not to exceed 15 watts.) #2 Cable—Keyed audio, 1500 CPS nominal, .050 volts @ less than 100 ohms #3 Jack—Sidetone/mixed audio from receiver for headphone operation. **Input:** #4 Cable and Plug—Audio from receiver output. **Power:** #6 RM—502R Mallory 1.35 volt batteries (not furnished). **Size:** 2⅜" x 3¾" x 6⅛". **Price:** $92.50

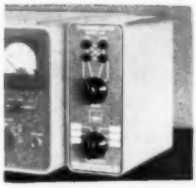
FORM 25-M-3-65. PRINTED IN USA

WATERS MANUFACTURING INC. WAYLAND, MASSACHUSETTS

Improved Operation for
COLLINS 75S-1 and KWM-2/2A

WATERS
"CHANNELATOR" ® — Model 349

The Channelator is a crystal-controlled "external PTO" providing up to six preselected EXACT crystal frequencies. With Channelator operation frequency-problems are eliminated on nets and round tables since BOTH receiving and transmitting frequencies are crystal-controlled. Novel oscillator circuit together with Waters special crystals permits "pulling" of the crystal to an EXACT frequency. The built-in heterodyne frequency meter provides precise measurement of each crystal. A function switch selects normal PTO or Channelator crystal operation as well as "split channel" use.

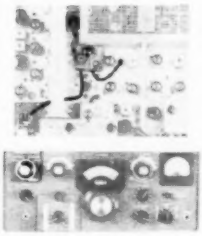


The Waters Channelator connects to the Collins equipment in minutes and may be mounted directly on the 75S series and KWM-2/2A. All cables and plugs are furnished. It operates from any fixed or mobile Collins DC or AC power supply. The front panel is reversible to permit vertical or horizontal mounting.

Price: $79.95 (less crystals)
Adapter Kit Model 349-27 for "S-line" installation $15.95
Crystals—any frequency, USB or LSB $6.00 each.

WATERS
Q-MULTIPLIER/NOTCH FILTER

The Waters Q-Multiplier/Notch Filter eliminates heterodynes and other unwanted signals in the IF passband. By combining an isolating amplifier and a tunable LC Bridged-T network with a Q-Multiplier, it provides a deep transmission null or notch of over 40 db, tunable across the entire passband. Operating with only a single tuning control on the front panel, the Q-Multiplier/Notch Filter becomes an integral part of the 75S-1 or KWM-2/2A. Escutcheon plates and knobs are matched to the Collins panel and no drilling of the panel is required. Operates in fixed or mobile service with any standard Collins power supply.



SPECIFICATIONS: 337-S1A (for Collins 75S-1) **Center Frequency:** 455 KC nominal. **Notch Depth:** Greater than 40 db. **Notch Tuning Range:** 2.5 KC. **Power:** (from 75S-1) .3 a @ 6.3 v, 1.5 ma @ 140 v. **Price:** $39.95

340-A (for Collins KWM-2/2A)
Center Frequency: 455 KC nominal. **Notch Depth:** Greater than 40 db. **Notch Tuning Range:** 2.5 KC. **Power:** (from KWM-2/2A) .3 a @ 6.3 v, 1.5 ma @ 275 v.
Price: $53.75

WATERS
"EVT" ELECTRONIC VERNIER TUNING

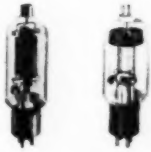
The "EVT" provides a 20-to-1 tuning ratio reduction on the KWM-2/2A. A stable, solid state varactor tuning device it attaches to the PTO without wiring change. Tuning range of ± 500 cycles from any PTO setting. Complete with matching escutcheon plate, knobs, hardware, instructions, etc.

Model 354: For KWM-2A without Waters Q-Multiplier/Notch Filter. For KWM-2 when equipped with Q-Multiplier/Notch Filter. (337-M2 or 340-PT)
Price: $23.95

Model 355: For KWM-2 without Waters Q-Multiplier/Notch Filter or with Model 340-A Q-Multiplier/Notch Filter.
Price: $21.95

WATERS UEW 572B
HIGH POWER AMPLIFIER TRIODE

The UEW572B is a zero bias power triode ideal for use in grounded grid amplifiers. Built in a hard glass envelope with heavy graphite plate, the UEW572B has a plate dissipation of 160 watts. It is directly interchangeable with 811-A tubes and one 572B is the equivalent of two 811-A's. Complete operating data including ratings and general characteristics will be sent on request.
Price: $13.95



WATERS UEW 3B28
XENON FILLED RECTIFIER

The UEW3B28 is a half wave, hot cathode, Xenon filled rectifier tube directly replacing the 866A. The UEW3B28 operates over a wide temperature range without heating or cooling and does not require prolonged conditioning before application of plate voltage. "Hash filters" are not necessary. Complete operating data will be sent on request.
Price: $6.40

WATERS MANUFACTURING INC. WAYLAND, MASSACHUSETTS

"to give you BETTER PERFORMANCE *and* GREATER VERSATILITY"

Waters "Convenience Engineered" ham equipment helps you to become a better operator with a better station.

WATERS
COMPREAMP™ Model 359

The COMPREAMP Audio Preamplifier/Limiter increases the effective speech power output of a transmitter up to four times. Self-contained and battery powered, the two-stage transistorized COMPREAMP is designed to be used with all types of transmitters.

COMPREAMP connects between the microphone (50,000 ohm dynamic or high impedance ceramic) and the transmitter microphone input connector without any wiring change. Provision is made for switching the Compreamp in and out of the circuit and for adjustment of compression level. Recommended for use with tape recorders and public address system amplifiers.

COMPREAMP SPECIFICATIONS: Input Impedance: 100K ohms, nominal. **Input Level:** .005 to .020 volts. **Gain:** (voltage) 10 db, nominal. **Output Level:** .060 volts. **Output Impedance:** 50K ohms, nominal. **Power:** 9-volt Burgess 2U6 or equivalent. (Not supplied.) **Size:** 2¾" x 3" x 4½". **Price:** $27.95 (less battery.)

WATERS
CLIPREAMP™ Model 372

The new Waters Clipreamp is a solid state, battery operated Preamplifier-Clipper designed for use with voice modulated transmitters to increase "talk power" and intelligibility under adverse band conditions. Frequency response is carefully adjusted for maximum intelligibility and minimum distortion. RF "flat topping" is prevented in SSB operation. Clipreamp is easily installed between high impedance microphone (dynamic, crystal or ceramic) and microphone input of transmitter.

CLIPREAMP SPECIFICATIONS: Voltage Gain: 10-13 db. **Frequency Response:** 300-3000 cps. **Input Level:** .020 volts, nominal. **Output Level:** .060 volts, nominal. **Impedance Input:** Suitable for high-impedance microphones. **Output Impedance:** 50,000 ohms. **Power:** 9-volt burgess 206 or equivalent, (not supplied) **Size:** 3 1/8" x 2 5/8" x 3 ¼" **Weight:** 6½ oz. **Price:** $21.95 (less battery)

WATERS
"NUVERTER"® — Model 346

The Nuverter adds 2 and 6 meter coverage to any ham superheterodyne receiver that tunes 10 meters. It is easily installed without modifying or drilling and requires no external switches or relays. A single function switch selects wanted frequency band and also transfers antenna connections between HF and VHF. Nuverter has separate all-Nuvistor converters for each band, high-stability crystal oscillators and an integral power supply. The receiver's automatic gain control may be fed into the Nuverter to provide complete AVC performance at VHF. Broad-banded circuitry covers 1.8 megacycles in three 600 KC segments on both 2 and 6 meters.

NUVERTER SPECIFICATIONS: Frequency Range: 50.0 to 51.8 mc; 144.0 to 145.8 mc. **Frequency Sub-Bands:** 50.0 to 50.6 mc; 50.6 to 51.2 mc; 51.2 mc to 51.8 mc—144.0 to 144.6 mc; 144.6 to 145.2 mc; 145.2 to 145.8 mc. **Output IF:** 28.5 to 29.1 mc (50 ohms). **Input RF:** 3 antenna inputs at 50 ohms (2 meter, 6 meter and HF antennas). **Power:** 115 volts AC or 12 volts DC @ .27 amperes and 125 volts DC @ 25 MA. **Sensitivity:** .1 microvolt SSB/CW. **Noise Figure:** 4.0 db maximum at 50 mc; 5.0 db maximum at 144 mc. **Size:** 2¾" x 6½" x 7½". **Weight:** 4¼ lb. **Price:** $175.

WATERS
COAXIAL FILTERS — Model 373-2 & 373-6

Waters new Coaxial Filters are double-tuned, resonant cavity band-pass filters for both 2 and 6 meter transmitters and receivers. Installed in 52 ohm coaxial antenna lines, the filter assures an outgoing signal free of the spurious frequencies that cause serious interference problems. (TVI, etc.) The filter provides rejection at the receiver front end of high-level out-of-band signals such as beats between local TV stations. No tuning adjustments required and insertion loss is held to 1.5 db maximum.

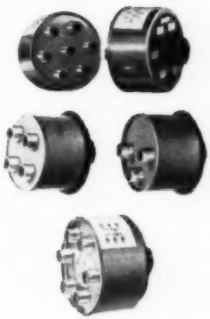
FILTER SPECIFICATIONS: 373-2 — Center Frequency: 146 mc. **Shape Factor:** 40 db — 12 max. 3 db **Bandwidth at 3 db:** 5 mc. nominal. **Insertion Loss:** 1.5 db max. **Maximum Power Level:** 100 watts **PEP. 373-6 — Center Frequency:** 51 mc. **Shape Factor:** 40 db — 20 max. **Bandwidth at 3 db:** 3 mc nominal. 3 db **Insertion Loss:** 1.5 db max. **Maximum Power Level:** 100 watts **PEP. Weight:** 2 lb. **Size:** 6¾" x 8¾" x 3⅝"

Price and Availability: To be announced

WATERS MANUFACTURING INC. WAYLAND, MASSACHUSETTS

WATERS
COAXIAL SWITCHES

Waters Coaxial Switches are designed for panel mounting and feature in-line orientation of the coaxial connectors. They occupy minimum space and are readily accessible for connecting and disconnecting. Waters switches add to the station appearance, are easily installed and provide efficient and convenient switching techniques.



SPECIFICATIONS: Internal Construction: Ceramic switch with silver plated conductors. **Power Carrying Capacity:** 1000 watts. **Insertion Loss:** Negligible. **VSWR:** Less than 1.2 up to 150 mc. **Mounting:** Mounts behind panel with 3 screws. **Hardware Supplied:** Mounting screws, escutcheon plate with provision for erasable marking; knob.

COAXIAL SELECTOR SWITCH — Model 335. Single pole, six-position for switching RF sources, antennas, etc. Has seven UHF (SO-239) connectors. **Price:** $12.95

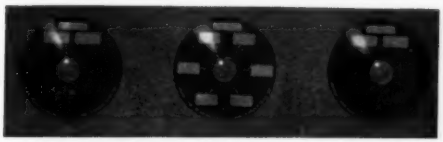
COAXIAL TRANSFER SWITCH—Model 336. Double-pole, double-throw internally strapped for switching amplifier in and out between exciter and antenna. Four UHF (SO-239) connectors. **Price:** $11.45

ANTENNA SYSTEM TRANSFER SWICH—Model 341. Single-pole, double-throw for switching RF device to either of two antennas or two RF devices to single antenna, etc. Three UHF (SO-239) connectors. **Price:** $11.45

DUAL COAXIAL TRANSFER SWITCH — Model 351. Double-pole, double-throw for switching converters, filters, etc. in and out of coaxial lines. Six UHF (SO-239) connectors. **Price:** $12.95

WATERS
ILLUMINATED KNOB Model 347

Waters Illuminated Knobs serve as pilot lights and position indicators. The Knob projects a light beam on the panel to identify position and has a lighted red pointer as a pilot light. Ideal for applications where the pointer position must be read accurately or identified from a distance or under poor lighting conditions.



Installation is simple. The knob contains the light and mounts on any ¼" shaft rotary control or switch. No changes required behind the panel. One wire provides the 6 volt source for light with the shaft serving as ground. **Price: $5.00**

WATERS UNIVERSAL HYBRID COUPLER
and PHONE PATCH — 3001 & 3002

3002 UNIVERSAL HYBRID COUPLER II

The Universal Hybrid Coupler II is an excellent phone patch that connects receiver and transmitter to the phone line for remote voice operation. Provision is also made in the Coupler to connect a tape recorder for both recording and playback of station QSO's and the telephone line. The hybrid circuit provides for effortless VOX operation of the phone patch. A built-in "Compreamp" speech preamplifier/limiter serves to increase the level of weak phone signals and also to avoid overmodulation when the local telephone serves as the station microphone. The "Compreamp" also functions as a preamplifier/limiter with the station microphone, if desired. Front panel is reversible to permit either horizontal or vertical mounting.

3001 UNIVERSAL HYBRID COUPLER
Identical to 3002 but without the "Compreamp"

SPECIFICATIONS: Input Impedances: Line — 600 ohms nominal. RX Output — 4 ohms nominal (varies with receiver output control). Mike—High impedance crystal or dynamic. Tape Recorder; Speaker—4 ohms nominal. **Output Impedances:** To Tape Recorder — ½ meg. ohm. To XMTR — 50K ohms nominal. RX SPKR — 4 ohms nominal.

PRICES: 3002 $69.95 (less battery)
3001 $49.50 (less battery)

WATERS MANUFACTURING INC. WAYLAND, MASSACHUSETTS

A. E. Blick VE3AHU
Box 37
Collins Bay, Ont.

The Design of Log Periodic Antennas

The performance of a lossless antenna will remain unchanged if all dimensions, in terms of electrical wavelength, are held constant. Thus, if all dimensions are decreased by a factor of τ, and the frequency is decreased by a factor $1/\tau$, the fields about the two antennas will be similar. The dimensions of the log-periodic antenna are such that the electrical properties repeat with the logarithm of the frequency. If the n radiating element is resonant at a frequency f, the next shorter element $n+1$, is resonant at a frequency of $\tau \times f$, where τ is the design ratio and equals $x_{(N+1)}/x$, x representing the length of the element. The frequency range from f to $\tau \times f$ is called a period of frequency and, if the variation in electrical characteristics is negligible over a period, variations can be assumed to be also negligible over the entire design range of the antenna.

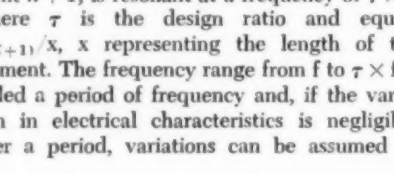


Fig. 1.

The log-periodic dipole (LPD) is an adaptation of the basic log-periodic antenna in which the "teeth" of the non-planar, wire, trapezoidal tooth structure are replaced by dipole elements and the angle between the two halves of the structure is reduced to zero. A schematic of the LPD is given in Fig. 1 showing the method of feed.

The symbols used in describing the antenna are:

α (alpha)—half the angle subtended at the vertex.

σ (sigma)—the relative spacing ratio = $d_X/2Ln$

σ'—the mean spacing factor = $\sqrt{T}$

τ (tau)—design ratio, or scale factor = $Ln/_{L1-1}$

n (subscript)—any element

n+1 (subscript)—next smaller element to "n"

a—radius of element

d_X—distance from any element to next smaller element

x—Boom length between shortest and longest elements.

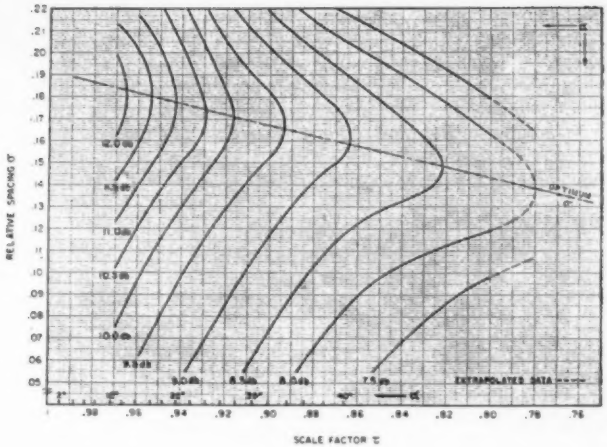
B—operating bandwidth = (max freq)/(min freq)

B_{ar}—bandwidth of the active region

h—half length of a dipole element

L—full length of a dipole element = 2h

Fig. 2.



Ro—input impedance at the front of the antenna

Za—average characteristic impedance of a dipole element $= 120(\log\epsilon \frac{h}{a} = 2.25)$ ohms

Zo—antenna structure feeder impedance (boom impedance) $Zo = 120 \cosh^{-1}\left(\frac{b}{2a}\right)$ where b = center-to-center spacing between the boom elements

It is normal to design an LPD antenna for a given gain and input impedance over a given frequency band. The relative size of the structure and the number of elements is of importance and these two factors will depend on the values of τ (an increase in τ means a greater number of elements) and α (increase in α means a decrease in size). The factors τ and σ are the main determining factors affecting the shape of the radiation pattern and there will be a value of σ, called "optimum σ" that will be an optimum for any desired gain and will give a minimum value of τ and SWR and maximum front-to-back ratio. A chart giving this relationship is shown as Fig. 2. The best design procedure is to start with the optimum value for σ and make a table for lesser values. The values for α, boom length, and number of elements, can be found from the charts given as Figs. 3 to 6.

As an example, let us design an LPD for use on 6 meters, fed by 75 ohm coax cable and giving optimum results for a maximum boom length of 10 feet.

a. Using values for optimum σ from Fig. 2 for a gain of 8.5 db $T = 0.822$; $\sigma = 0.148$.
b. From Fig. 3, $\alpha = 17.8°$
c. From Fig. 4, $B_{ar} = 1.8$; $B = 55/50 = 1.1$; $B_g = 1.98$
d. From Fig. 5, $x/\lambda_{max} = 0.38$; $\lambda_{max} = 984/f = 19.65$ feet. $x = 19.65 \times 0.38 = 7.46$ feet.
e. From Fig. 6, number of elements = 4.

A second run, using a gain of 9 db, gives a boom length of 14.2 feet.

The value of Zo is now determined to give the required value for Ro. The ratio h/a should be the same for each element, but practically the element diameters can be the same for each element, or scaled in groups and the average h/a used. Let us use ¾" diameter tubing for the elements and, taking the value of h at 52.5 Mc, $h/a = 600$. The values of Za and σ' are then calculated and give $Za = 500$ and $\sigma' = 0.1725$. The relative feeder impedance Zo/Ro can be obtained from Fig. 7 which gives, $Za/Ro = 500/75 = 6.66$; $Zo/Ro = 1.1$; $Zo = 82.5$ ohms.

The length of the longest dipole element is given by $\lambda_{max}/4 = 58.95$ inches. The lengths of the other three elements are given from the relationship $h_{N+1} = h_N\tau$, which results in:

$h_1 = 58.95''$ $h_2 = 48.4''$
$h_3 = 39.8''$ $h_4 = 32.7''$

The distance between the elements is given by: $d_N = \sigma 4h_N$, and this gives the distances as:

$d_1 = 34.85''$ $d_2 = 28.65''$
$d_3 = 23.55''$

Ideally, the boom elements should be conical but, in practice, two parallel cylinders can

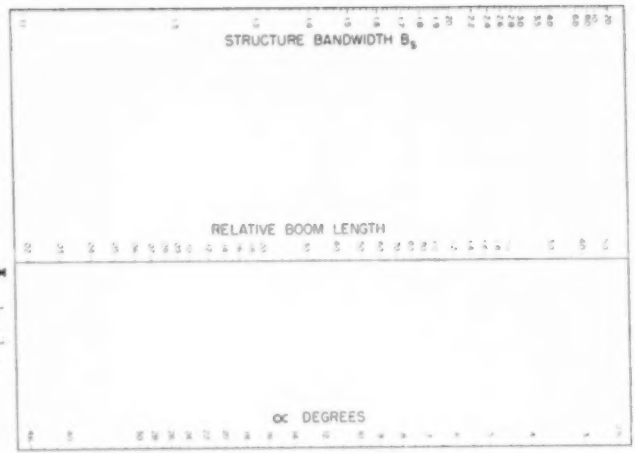


Fig. 5.

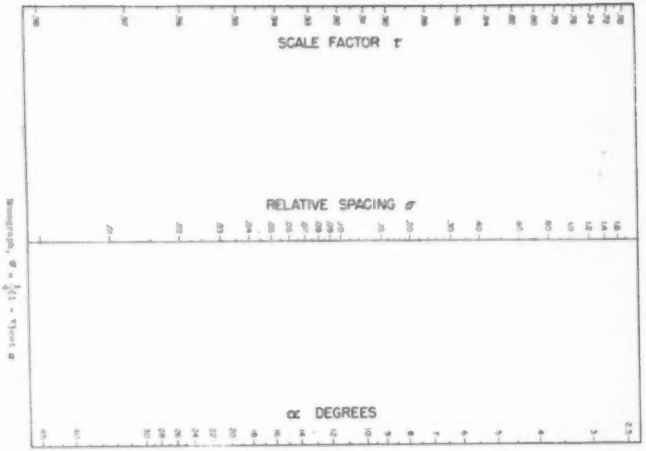


Fig. 3.

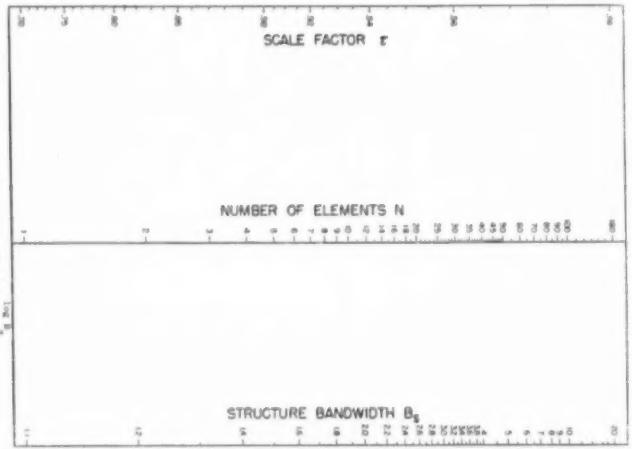


Fig. 6.

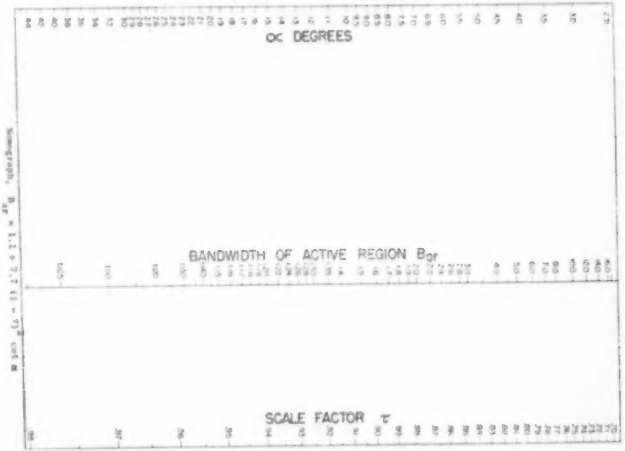


Fig. 4.

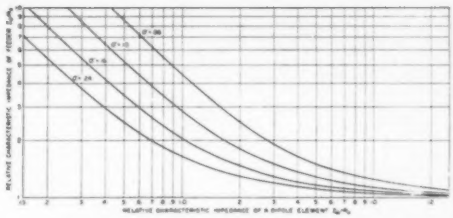


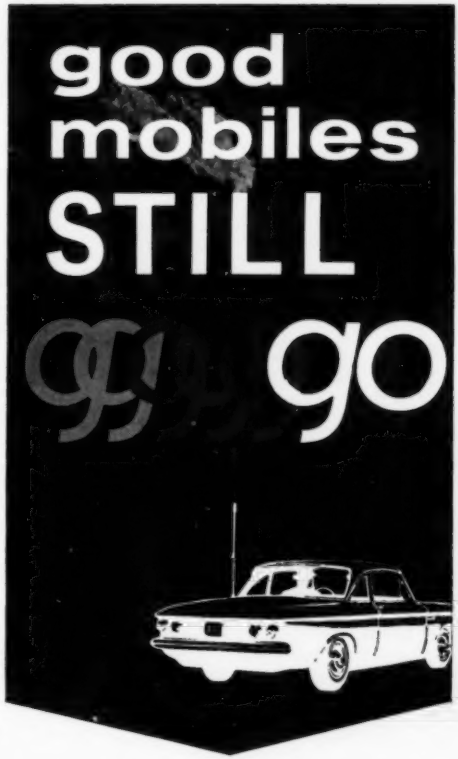
Fig. 7. Relative feeder impedence vs. relative dipole impedence.

satisfactorily replace the cones as long as the cylinder radius is small compared to the wavelength. The spacing between the two boom elements can be calculated from the formula for Zo and for our calculated value of Zo = 82.5 ohms, b/2a = 1.244 inches. This means that, using one-inch diameter tubing for the booms, a center-to-center spacing of 1.244 inches is required or the booms will be separated by a quarter inch. To keep reflections from occuring, the antenna should be terminated in its characteristic impedance (Zo). However a short-circuit across the boom elements at a distance of $h_1/2$, or less, behind the largest element will prove satisfactory. This point can be found experimentally by running a shorting bar between the boom elements until the lowest SWR is obtained on the lowest frequency in the antenna range.

The LPD may be fed in three common ways. (1) By connecting a two-wire, balanced line at the junction of the boom and the smallest element with the characteristic impedance of the line matching the input impedance Ro. (2) By connecting a balanced, two-wire line at the large end of the structure with the boom elements forming a 4:1 balun transformation. Each boom can be considered to be a coax feeder constructed by inserting a wire in the center of the boom of each structure. For use with 300 ohm line, the formula D/d = 12.25 can be used with D the inside diameter of the boom and d the outside diameter of the wire. The two inner wires are cross-connected to the outer booms at the front of the antenna. (3) A coax line, with characteristic impedance equal to the input impedance of the antenna, may be inserted through the back of one of the boom elements. The coax shield is connected to this boom and the center wire to the other boom at the front of the antenna.

Additional details on the construction of the LPD antenna can be found in the article "A Wide-band, high-gain antenna" that appeared in the Nov. '64 issue of 73 magazine.

. . . VE3AHU



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Gus Browning W4BPD

Gus

Part 1

I would like to start this story by telling you that at this very moment I am setting at my typewriter in my bedroom at the home of N. Chhawna, AC5PN, in Dechencholing, Bhutan, in the High Himalyas. At this moment all ham bands are closed. But to do the story up properly I must start at the beginning of my life so that you can understand how all this business of traveling around the world just to put one of these rear countries on the ham bands so that the world's hams could get a chance to contact a "new country" got started.

I was born on Nov. 25, 1908 on a Tuesday (according to an electronic calculator in Schneider-Kreuznach in Bad Kreuznach Germany it was a Tuesday) in a small town in South Carolina. At the age of some few months my family moved to the small town of Elloree, S. C. That's where you might say I got my start—and boy what a start it was!

Ever since I was a young kid down on that poor cotton farm I have wanted to see the world. To be truthful, I never had any hopes of seeing further than maybe Orangeburg, a small city 21 miles from my old home town of Elloree. But you will see that things did happen to change all of this.

I well remember one Sunday when our old cook who had been on a visit to Orangeburg returned home and told us all about the Aeroplane that she saw. She told us that there were some folks sitting in rocking chairs on the wings and that they were rocking while the plane flew over.

Now this set my mind to wondering about the world. Just where would you be if you were to sit in one of those rocking chairs for one whole week, and the plane just kept flying all that time? I figured you might be in Arabia where all those veiled ladies were with the camel caravans coming in from across the dessert. Maybe you would be in the middle of Tanganyika with all the natives with the big spears and long ornaments hanging from their ears, or again you might be down on one of the palm covered islands in the Indian Ocean looking at the island ladies dancing under the palm trees under a big full moon! Well, I did get to all those places and a lot more, many years later on.

I can truthfully say if there were one thing I was sure of it was never seeing such sights. Even getting to Orangeburg once each year to visit the County Fair was a real adventure that we talked about many days and nights before and after each visit. I didn't think I would ever get to go to those far away places in North Carolina or down in Georgia. Things with us on the farm were very bad; then they got worse. The boll weavil that got in my dad's cotton did not help much either. But I suppose I should thank Mr. Boll Weavil because he assisted my dad in making up his mind to leave his cotton fields in South Carolina and head for that "easy money" down in Florida. He told us that there was plenty of money and oranges in Florida. Now that statement "plenty of oranges" interested us kids because if we got one orange a week in South Carolina we were lucky; of course on Christmas we always got two oranges.

Finally, we sold the farm and my father said we were moving down to Florida. There was a lot of celebrating that night, and we stayed up real late (nine o'clock) and did a lot of talking and planning.

To make this trip my dad bought a third

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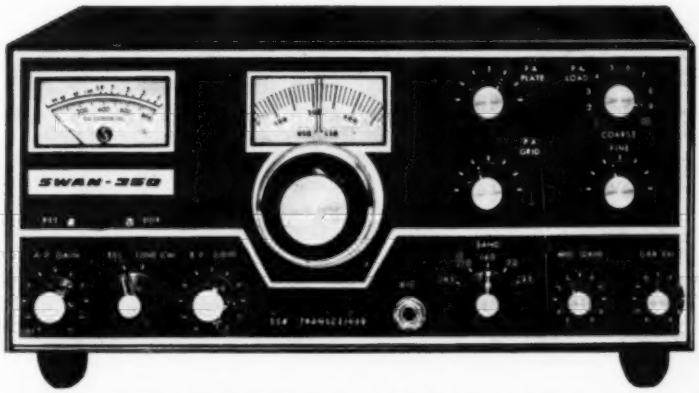

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hand model "T," and you talk about a time! We all wanted to learn to drive that thing; it was one of those arm breaking model "Ts." My dad got it twice and my oldest brother Bud twice, and a few of our friends had an arm or two broken also. None of us had ever driven a car up to the time Dad bought this one. I remember my oldest sister Lorena and what she did to that Model T. We got it going and she drove it OK, but she forgot to put on the brakes and right through the garage she went, right on out in the plowed field, where it stalled.

Now it was my father's turn. He got it going down the road and headed in a country church yard to turn around. Church was in full swing, and somehow he forgot how to stop the thing; up the steps it went and if the church doors had not stopped him, right on in church he would have gone, all the time hollering, "Whoa, whoa, consarn it, I said whoa." After a few months of practicing, Father, Lorena and Bud did learn more or less to control that Fliver. So we started in earnest getting ready for that trip (my first DXpedition) to Florida. (At this time I was not sure whether the world was flat or round, as our school teacher said it was. It was flat to me because there was only flatness everywhere I looked.)

We packed up that fliver with 6 kids, Mom and Pop, a few chickens, Lord knows what all else, and away to Florida, the land of plenty of money and *oranges*.

Back in those days there was not a single inch of paved road between Elloree, S. C. and Orlando, Florida. It was a real American Robinson Crusoe trip all the way: lots of mud which we got stuck in many times and very few bridges. We crossed many rivers on a ferry pulled by a horse on the other side. I suppose this trip made traveling get into my blood. Well, when we got down near Orlando, Florida and started seeing those orange groves, my father, being a regular fellow, stopped any number of times and let us kind of "borrow" a gunny sack full of oranges. Boy, did we eat oranges! Even to this day I love to eat oranges by the sack full and have never got tired of them.

When we got about 5 miles northeast of Orlando, Florida, we just pulled up under a big shade tree and we pitched camp. No one seemed to mind the fact that we did not inquire who owned the land.

My father took his few hundred dollars and went looking for land. He found a nice little tract almost on the shores of Large Lake Fairview and he bought it. But his money was almost all gone, so we went to work with someone who was wrecking some houses in Orlando. Every night he brought home a big pile of that used lumber and a bucket or two of bent used nails. It was the kids' job to straighten those bent nails and to assort and stack the lumber. This kept up for a number of months until we had enough nails and lumber to build a house. My father quit work for a month and all of us pitched in and built the house. I don't think there was ever a house built in Florida any cheaper.

Well, school time finally arrived and we walked the two miles to meet the school bus to take us all to the Winter Park school. Over in Winter Park I heard about a man who was a radio amateur (at that time I had no idea what one was). His name was W. J. Lee and his call sign was 4XE. I made it my business to meet him, he turned out to be one of the nicest men I have ever met. I remember him trying to explain to me that he was one of the very first people in the world to use quartz crystals to control his transmitting frequency (Mr. Popoff excepted, of course).

At that time all this was miles over my head. In fact my knowledge of radio was zero minus; I had never heard or even seen one yet. But the bug had bitten me and I decided that I must learn more about this radio business. Somehow I got some kind of a radio magazine describing how to build a L. M. Cockiday one tube set (why I picked such a circuit I am still wondering). My problem was to get some money to buy the parts and boy, that $8.50 tube looked like a gold mine. I sold newspapers on the streets, and mowed lawns every afternoon for months and months before I scraped up enough money to order all the parts except that $8.50 tube.

I wired the radio on one of my mother's breadboards (they said breadboard and I was very careful to do just exactly what they said). I guess I checked that circuit over hundreds of times and it looked good to me.

After a few more months of scrimping and saving I had my $8.50 and ordered that tube (I think it was a WD-11). When it arrived I guess I was shaking like a leaf and in the excitement somehow the 45 volts got hooked to the 1.5 volt circuit and that tube went up with a flash. I went running in the house crying my head off saying I had blown up my tube. My father said, "Didn't I tell you not to throw away your money on that radio junk?" Well, my Aunt Polly, who was teaching school was staying with us said, "Gus, I will give you the money so you can get another tube."

Away went the money to some company up North for another tube. This time you can

be assured that those battery wires were wired up right. Of course the set didn't work, and I monkeyed with it for about 6 months before I got a signal from it. To this day I don't remember just what was wrong. But you should have seen the excitement around our house that night. The only signal I could tune in was old KDKA in Pittsburgh, Pennsylvania. My father was the first one who heard it work, and he said, "I knew Gus would make it work."

Then I became a "radio expert" and got a job working in the afternoons in a radio store in Orlando. My job was sweeping out the store every day, dusting off tubes, and later on I was instructed on how to test tubes. My salary was 25 cents per day and 50 cents on Saturdays. But I was in "Radio," that was the main thing. You know how the bug bites, and it had me good and proper.

Along about this time I met NU4ACZ, good ole Tony, and he told me all about ham radio. Now you talk about the Radio Bug nibbling on a fellow! This one really had the hammer lock on me. But old Tony told me that the first thing I had to do was to learn the code before I went any further. I went home and told the folks about this and my sister Lorena said she wanted to learn the code too because she wanted a job at Western Union. I got a door bell buzzer and made a key with an old hack saw blade, and my sister and I learned the code, though it took us six months. But we had learned Land Morse! To make matters even worse my sister had learned Land Morse but on a door buzzer! This really put me in the dog house sure enough. Tony had forgotten to tell me that there were two codes!

My mind was made up. I would learn this darn code or bust. I had by that time built a short wave receiver and by the hour I would sit with a pencil in my hand and write down a stray letter every now and then. I learned it after about a year's practice. Then, after a few more months of study, I felt like I could pass the Ham license test. After three trials I did.

I was now "one of the boys." I got an old Hartley circuit going on 40 meters, operating on a 6 volt battery and 180 volts of "B" battery with an input that was all of 6 watts. After trying out many different aerials I finally got up a ½ wave with a counterpoise and the fun really started.

I had heard Ole Tony working DX, places in Germany, Belgium, England, etc., and I had made up my mind that I could do it too. For over 6 months I had tried using an aerial and ground with no results at all, as far as working stations out of North America. But boy, when I put a counterpoise in place of the ground, I hit pay dirt! I worked stations in Europe, South America and even Australia. Their prefix was then OA, the letter O standing for Oceania and the letter A for Australia. The prefixes in those days were very simple, nothing like these new prefixes you hear now.

My Pop was an Old Timer and a kerosene lamp was good enough for him. He absolutely refused to have electricity wired to our house. I was stuck on batteries and it looked like that's all I would ever be able to use.

My brother Bud moved up to Philadelphia, Pennsylvania and he wrote me I could get a good job in radio if I came up too. I was not interested in the job; what interested me was that if I went up there I could have a transmitter operating on the ac power mains.

Have you ever tried to go from Orlando, Florida to Philadelphia with $2.50 in your pockets? Have you ever spent nights in jail while hitch hiking? One jail in North Carolina would not let me out the next morning, as the man who let me in went on vacation that same night. Here I was in a mess boys, and not the only mess I have ever been in.

MORE NEXT MONTH. Did I get out of that jail? Did I serve six months on their chain gang? Next month tells about that!

. . . Gus

Envelope stuffers available from 73 for the price of a stamped self addressed envelope. One envelope per stuff.

4. Maxwell Meyers W2BIB Coca-Cola vs ARRL letters. Read for yourself how the League got K2US thrown into the Coca-cola pavilion attic instead of having a ground floor exhibit . . . thereby losing amateur radio enormous publicity.

53. Synopsis of the K2US/WA2USA story by Dana Griffin W2AOE . . . telling how the ARRL again sabotaged amateur radio for its own gain. This is the disgusting story of the scuttling of WA2USA.

32. An answer to the fantastic distortions in the Washington Amateur Radio Newsletter (mouthpiece for ARRL Hq) June 64 issue. Of slight interest only if you had the misfortune to get a copy of the WARN bulletin.

37. Ditto WARN July 64. More trash . . . lies . . . and mudslinging. Fortunately the Foundation for Amateur Radio in Washington seems to have been able to stop this poisonous publication.

33. Those few of you who read the July 64 issue of CQ and found the wealth of 73 publicity in it may be interested in my reaction. This, my "Cuke Letter," is it.

29-30-31. We still have a few copies of an exchange of letters with Doug DeMaw W8HHS regarding a particularly stupid editorial in his VHF'er, an ad sheet put out by the now defunct Comaire Products. Not worth reading.

All the above are in short supply . . . we'll substitute if we run out of your request. Send SASE's to 73, Peterboro-ugh, New Ham Shire.

Jim Kyle K5JKX
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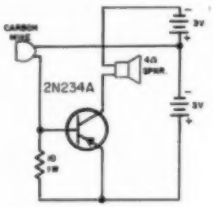
The 73-A-Phone

Ever need to shout louder than you can? Perhaps on a DX'pedition when you were on top of the hill and your buddy was just starting up—without the chow?

Here's a device which can help you out in such a situation. We dubbed it the 73-A-Phone not so much because it's appearing in these pages as because (if you use the specified speaker or one of similar characteristics) it will produce a 73 db sound level at a distance of some 90 feet, or the same 73 db sound level inside a room 10 feet high by 15 feet wide by 20 feet deep. This 73 db is twice as much power as average conversational speech levels, so should be clearly heard.



73-A-Phone

As you can see by the schematic, there's not much to the 73-A-Phone. A carbon mike (the Western Electric F-1 button is ideal for the purpose and usually rather inexpensive unless you get caught), a 10 ohm resistor, the 2N234A transistor, and the speaker are all there is to it except the batteries. For portability these can be flashlight cells, but the larger lantern type are preferred for longer life.

While the University MIL paging speaker is recommended and is the only one I tried, any 4 ohm speaker will work with this circuit. The MIL has a self-contained horn and is a high-efficency unit, which is why it was chosen, but is admittedly a trifle expensive for such an otherwise simple device.

The transistor delivers approximately 1/3 watt in this hookup. This may not sound like very much, but if it's driving an efficent speaker it's a pretty potent package.

Many variations of this simple circuit are possible, but we don't recommend any drastic increase in supply voltages. Under no circumstances should you increase the base supply voltage above 3 volts; you're free to increase the collector supply as high as 9 volts, though, at the risk of incurring possible distortion. This, naturally, would increase power output somewhat.

With conventional speakers, this can make a most usable portable PA system for hamfest use. The batteries, transistor, and resistor can be placed inside the speaker box, leaving only the wire running to the mike button. Take care to avoid feedback in such use, though—this gadget will surprise you with its sensitivity!

. . . K5JKX

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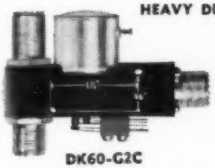

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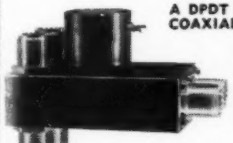

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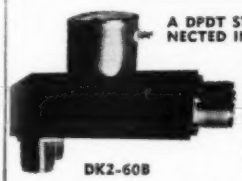

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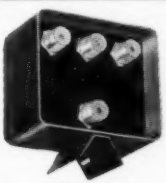

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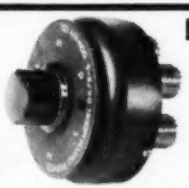

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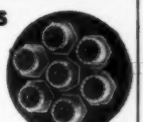

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The 1215'er

How to build (easy) a good super-heterodyne receiver that tunes from 1200 to 1300 mc using a $1 tube (better make that $2 if you insist on new brand names) and a store-bought capacitor, a hack-saw, soldering iron, and tin snips. A low cost transmitter, and 12 element yagi are also included.

Introduction

The frequency region known as UHF, 300 to 3,000 megacycles, is a fascinating place for the true experimenter, but *there are problems*! Right away on the first amateur band in it, 420 to 450 mc, techniques begin to get fussy. Circuits are described as, for example; "L1 is a ¾ inch brass strap, ¼ inch wide, soldered to pin 5"; transmitter circuits feature $17 tubes; and "a real low noise rf amplifier tube" costs $10 and up.

With this and lot's more like it in mind what would you say to a $1 tube used in a good, variable capacity-tuned local oscillator for 1215 mc? There is no mystery about it (except maybe a little in the cathode circuit) but it may sound as though there was before you really study the subject.

A great many electronic problems, defective operation, unsatisfactory results, etc., are found to be the result of not one but several troubles working together. We have mentioned this in a previous article (73, Feb. 63). In as many as six different items, the absence of any one of them can cause inability to reach the desired goal.

On 1200 mc it's the same way. It takes a number of things together to operate inexpensively.

Details

1. The tube: So far as I know there are only a few low cost tubes that will perform on 1200-1300 mc. A. The 6AF4, B. the 6T4, and C. 6DZ7. As usual, the radio and TV industry has given the amateur a lift. When it is built for those boys you can be sure it doesn't cost much! I'm not kicking. On the contrary, I look for the "82 channel law" to benefit us amateurs like mad. Like maybe with a $2 low-noise lighthouse tube. And UHF tuning capacitors for 25 cents, maybe.

2. The tuning capacitor: Good old Hammarlund Co. has made these for some time. I do not know of any other capacitor except the Hammarlund type macbf butterfly type that

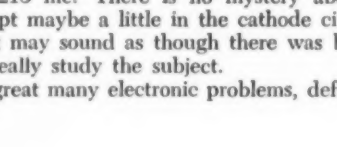


Fig. 1. Quarter wave oscillator.

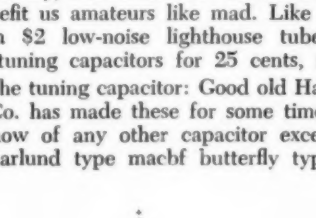


Fig. 2. Half wave oscillator.

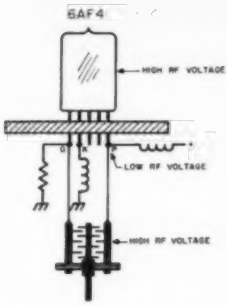
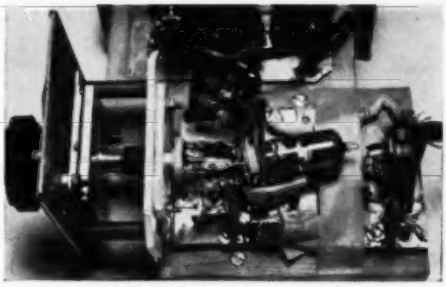


Fig. 3. Practical half wave oscillator.



Receiver local oscillator/Transmitter

vill do the job. I mean of course, drill a single hole, use a 10 cent shaft extender, an 89 cent slow motion dial, and tune from 1100 to 1300 mc.

3. Half-wave lines: Let's try it this way. Half wave lines are well known but wait and see what happens when you add all together. Fig. 1 shows a simplified circuit of a 200-300 mc quarter wave line oscillator. Note that the "line" is acting like the old familiar pre-war ulta-audion circuit, with the plate on one end and the grid (out of phase, which is of course correct) on the other. This works fine up to a point. This is where the line shorting bar has arrived in the vicinity of the socket and grid capacitor. If you squeeze everything like mad it will go well over 500 mc, but don't use this circuit there! Fig. 2 shows a much better way. Note that now there is a half wave line on *each* line, so that if you consider the phase out and back you could call it a "full-wave oscillator". The trick now is that you can jam the first quarter wave right into the tube and, as in Fig. 3, you can still tune it with an "ordinary" (one that you can buy ready-made) capacitor! Even to 1400 mc! With the smallest Hammarlund butterfly type, 2 stator and 3 rotor plates, it tunes from well below 1100 mc to over 1300.

4. Don't go away yet. There are still some other ingredients. The shape of the lines next. As you go up in frequency towards microwaves (1400 mc) you will find more and more that the configuration of what you are using becomes of greater and greater importance. This leads eventually to waveguides but these are not in today's lesson. However, the use of flat opposed straps of thin brass (should be silver-plated) for the "lines" in Fig. 3, which is the same as Fig. 2 but going up in frequency, is a must.

5. Socket: Believe it or not, there is a socket used! It just happens that for UHF TV there is a very thin porcelain socket, which grabs the tube pins right up close to the glass base of the tube and allows you to make connections which are very short. Don't try the usual VHF kind. Believe me, you need everything working for you at 1400 megacycles. You don't have to go to 1400, but if 1300 is the end of the line you won't do very well on 1296.

6. The "ground-plane" chassis: It has been found by trial and error that on positioning both the lines an equal distance, about ¾ inch, from the base plate on which the oscillator is built, the maintenance of correct phase will be aided. Just one thing in mind, if you make a Chinese copy it will work up to 1400. Most of those I have built are still oscillating at 1500 mc, but that's it. The end of the line. Remember, this is still a $1 tube plugged into a socket.

7. The cathode circuit: Here there might be a little "magic". A "good" circuit (that is, expensive) on L. band (1200) with a plunger tuned coax cavity between the plate and grid

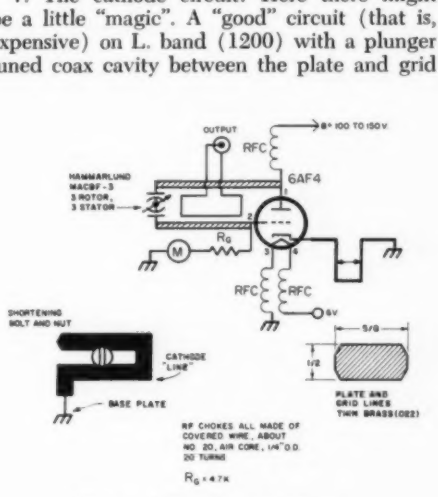


Fig. 4. L.O. and transmitter.

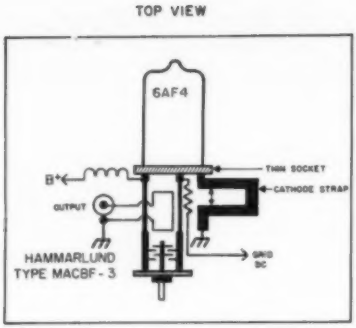


Fig. 5. Top view of oscillator.

of a 2C40, and another between the cathode and grid, will have a relatively easily determinable phase relation between the cathode and the plate. This is known as "in phase", or, as the cathode goes positive, so does the plate. The grid goes negative, "releasing" the plate which goes positive, etc. However, in an inexpensive "TV" triode such as the 6AF4 the plate, grid, and cathode are all in there together. The grid does not separate the plate from the cathode as in the 2C40. The plate-grid capacity of the 6AF4 is 1.9 mmf, which makes the fixed capacity on the tube end of the lines in Fig. 3. Now, what about the cathode? The "bible" says C gk is 2.2 mmf, and C kp is 1.4, but this doesn't help much. So, back to the good old "trial and error" again. After all Faraday didn't do too bad using this method a good portion of the time. After some years of it I have evolved a method of treating the cathode portion of triode oscillators that at least works, even if it isn't exactly obvious just how. A certain small amount of inductance down to the base plate from the cathode does the trick. It tunes quite broadly which is just as well, but it does peak up and it is repeatable. (This means that you can build a lot of them and they will all show the same kind of cathode tuning. I have built several "three-rod oscillators" in which the cathode was definitely tuned with respect to the grid, but that is another story.)

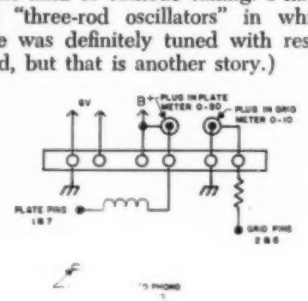


Fig. 6. Metering and power connections.

Construction Details

Now, with the seven items listed above in mind, we will build the oscillator of Fig. 4. Once again thin copper-clad bakelite makes an excellent baseboard. Mount the Hammarlund type macbf capacitor on the vertical insulating front panel as in Fig. 4B. The grid and plate lines, the UHF socket and the tube make a unit which may be held together and supported by soldering to the tuning capacitor. The socket may also be supported by a piece of insulator if you wish to make the assembly stronger. The B+ rf choke must be soldered directly to the plate pin (pin 1) of the socket, and the grid resistor directly to grid pin 2. That is, with the tube mounted as shown, which it must be, use the uppermost pins. Note that the plate pins are 1 and 7, and the grid pins are 2 and 6. Details in Fig. 4. This means that the solder which holds the socket pin to the brass plate line also holds the end of the plate choke. There isn't too much room there but it does work. Ditto for the grid resistor and grid line.

Firing Up

I generally use a couple of phono jacks for meters on the cable strip. See details Fig. 6. This frees your meters for other rigs. With 6 volts ac on, the tube should light up visibly. If everything is ok the plate current should rise as the plate voltage is turned up. It's a good idea to have a variable plate voltage supply for these tests. At somewhere around 15 to 20 ma the tube should start to oscillate and the grid current should begin to rise also. Plate current of some 25 ma may be found

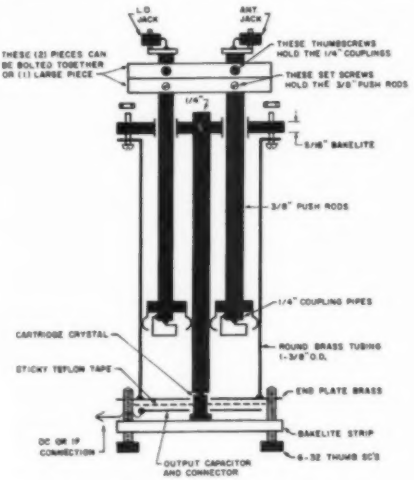


Fig. 7. Cavity mixer for 1215 mc.

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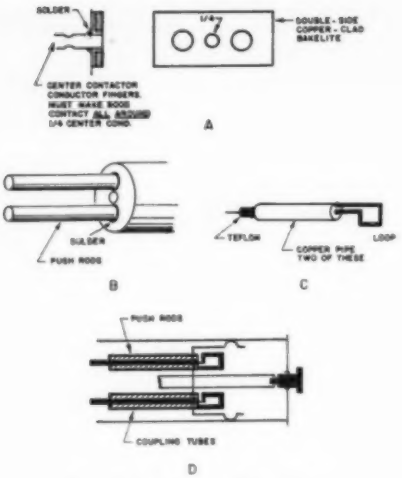
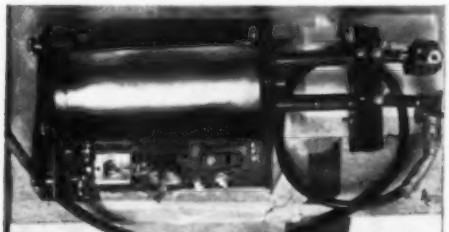


Fig. 8. Details of the cavity.

at 1100 mc rising to over 30, or even 35, near 1300 mc. The frequency of this unit can be adjusted for 1200 to 1300 mc, less the *if* frequency used. This little word "adjustment" actually means unsoldering and cutting the brass strips or making new ones. That's just part of the fun. For an *if* amplifier I have been using a slightly modified ASB-7, double frequency *if*, first stages on 52 mc. A low cost do-it-yourself *if* will be described later, but there really are (or were) loads of surplus wide band *if* strips around! Don't forget that 1215 is the modulated oscillator portion of the band, by general agreement, and this means an *if* bandwidth of several megacycles, not kilocycles. Use whatever dial you wish for the tuning control. Don't forget that the butterfly capacitors tune only 90 degrees.

Good Cavity Mixers for 1215 mc

By good I mean ones that really tune, putting 1215 into the crystal, the desired *if* out, and nothing else! This is a long story, so settle down. If you do you will learn how to make



Typical cavity.

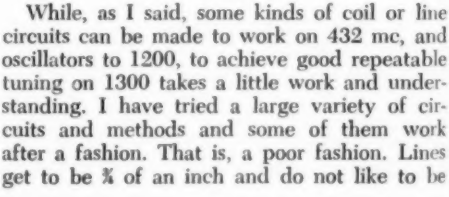
Push rod for inside of cavity.

a good tuneable cavity for 90 cents. I have made several of them and have been using them ever since. They are also easy to take apart and service or modify. You can put tubes, transistors, or diodes in the business end of them.

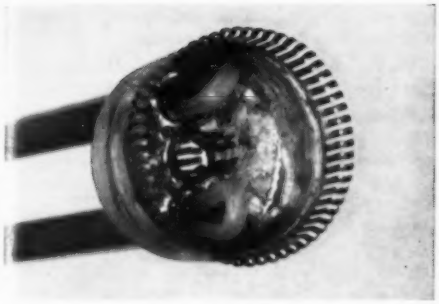
These cavities also have considerable "growth potential" as they say on Madison Avenue. If you make the *if* output coils plug-in, you can also use the cavity as a basic element for a narrow-band converter later. Plug in a 14 mc (or other, to suit your communications receiver) *if* coil, (see again Fig. 9.) remove the tuneable local oscillator cable, Fig. 7, and plug in a fixed tuned local oscillator chain. That is, later on, when you either make one or get one. This tends to sort itself out automatically. The customers generally fall into two groups. They have quite a lot of time and not too much cash, (usually a youthful group), or they will have more dollars and not near so much time available. And what time they do have they want to spend operating. This more or less describes the "family man." The main body of this article is obviously slanted towards the first group. On the air I have noticed that the amateurs interested in 1200 mc are almost always quite young. Of course there are always a hard core of born experimenters who carry on with this sort of thing till they die, but they are not so numerous.

Cavity

While, as I said, some kinds of coil or line circuits can be made to work on 432 mc, and oscillators to 1200, to achieve good repeatable tuning on 1300 takes a little work and understanding. I have tried a large variety of circuits and methods and some of them work after a fashion. That is, a poor fashion. Lines get to be ¾ of an inch and do not like to be



Another cavity.



End of push rod.

enclosed. Condenser tuned coax cavities are also about ¾ of an inch long. I have made some of them work but they are still nothing like the plunger tuned coax tuner I will describe here. The difference is immediately noticeable. Fig. 7 shows a pictorial diagram. Now don't be scared by it. While this looks similar to previous pictures you have seen, there is no lathe or machine shop work in this one. You understand, I have nothing against lathes personally, it's just that I have never learned to run one, and having obtained my first license in 1923 (2BAV) I'm not likely to learn now.

The following items should be procured at the plumber's shop: thin wall brass tubing of 1⅛" and 1¾" O.D. copper tubing, ⅜" and ¼" O.D.; clean .022 brass plate. Now, cut a half inch length of the 1¾" O.D. tubing, and solder on the finger stock. A small piece of steel wire, or enamel wire will help hold the finger stock in place while soldering. Or use a small finger-vise or clamp. Now solder the finger ring to a piece of copper clad bakelite, which has first had three holes drilled in it, Fig. 8A. The result should be as in Fig. 8B.

Now strip the outer conductor from two lengths of Teflon insulated RG58/U and slide them into the quarter-inch copper pipe, making small loops sticking out of one end of each pipe, as in Fig. 8C. These "coupling pipes" are then inserted inside the push-rods, see Fig. 8D, and positioned temporarily by the 6/32 knurled thumbscrews shown in Fig. 7. The loops, Fig. 8E, should turn freely at least 90 degrees inside the cupped (inside) end of the shorting plunger, one on each side of the center conductor (see Fig. 8E) allowing the coupling of the antenna and local oscillator to be varied independently as needed. Some lengthwise variation in the positioning of these loops may be tried, but better keep them well inside the finger ring, as per Fig. 8E.

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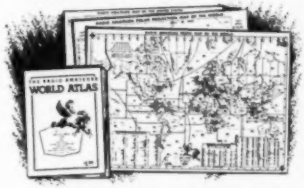

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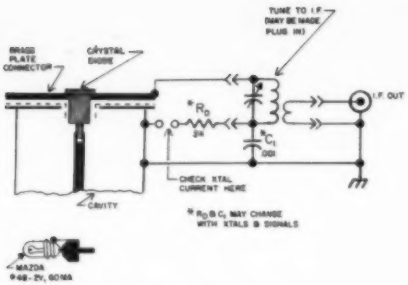


Fig. 9. *if* output.

Fig. 9B. Dummy load.

The other ends of the cables may be brought to jacks as in Fig. 7, or may be left longer and fastened directly elsewhere as needed. The brass end plates, Fig. 7, should be soldered to the outer wall. Sticky Teflon tape, perhaps two sheets of .002, is applied to the end plate from the "output capacitor and connector". See again Fig. 7. This little brass plate (see also Fig. 9.) is quite important. It bypasses the rf (1200 mc) but leaves the DC, in the case of use of the cavity as a wavemeter, or the *if* in the case of a mixer. Fig. 9 shows a simple *if* circuit that has never failed me yet. You can make the brass plate larger for more bypass action, or smaller for use with a higher *if* frequency, such as for a TV channel when using this cavity as an ATV converter. Notice that the brass plate and the outer shell, or "ground" form a fixed capacitor across the *if* output transformer primary, and so will be in parallel across the *if* tuning capacitor. If a slug-tuned *if* is used then it may constitute the fixed tuning of such a circuit.

So far, this type of cavity, with the crystal diode directly across the "hot" end, puts out more DC as a wavemeter, and more *if* as a mixer, than anything else I have encountered yet on 432 and 1296. It is also an excellent filter for the frequency to which it is tuned, as it is very positive in tuning. For example, 1296 stays at one spot on the dial with different antennas and different local oscillators. This is due to an extremely important principle in VHF and UHF work. A large cavity, such as this one, has a terrific "short circuit capability" for any frequency except that to which it is tuned. This shows up like mad in front-end work, where a small-wire coil will pass all kinds of images, harmonics and other junk. The large properly made cavity will not! You can also put your hands all over the outside with a signal on the inside and no change in tuning or output will be found.

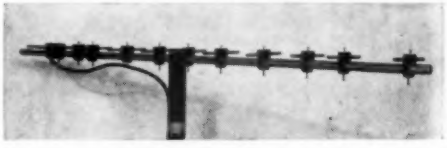
This about finishes the "1215 Receiver" article except for station operation. As described it tunes nicely with test transmitters and the heavy radar signals which are heard almost anywhere in New England.

Low Power 1215 mc Transmitter

So far I have used the same type of oscillator for transmitting as the one described for use as the local oscillator. About the only difference is that for the local oscillator use about 30 to 35 ma plate current, whereas the xmtr can run 40 ma. (If you have half a dozen 6AF4's on hand, live it up! I still wouldn't go over 50 ma. Anyway, you're on your own there.)

The B+ for the transmitter also goes through a small 5 watt modulation transformer. A single 6AQ5 more than modulates the 6AF4 with a carbon mike and high gain mike transformer (30 ohm to 500K). Be sure to use a gain control on the grid.

It is also handy to make the output coupling loop (Fig. 4) variable, because when the beam is tuned up properly, it can easily overload the oscillator and block it off. When in that condition, putting your hand on the radiator or reflector will detune the beam plenty and bring the oscillator back into action again. This of course shows that the beam is tuned up. Or at least part of it! I mounted a piece of quarter inch bakelite rod through a thick piece of upright bakelite with a locking thumbscrew. With a one foot piece of RG58/U cable soldered to the output loop, which is quite small, about ¾" long by about 3/16" wide, a no. 48 Mazda bulb lights easily on 35 ma plate current and shows about 200 to 300 milliwatts of 1215 mc rf when using 45 ma on the 6AF4. I mount these 60 ma 2 volt bulbs on a phono plug with coax leads. See Fig. 9B. They are handy rf power output indicators. Don't leave them in circuit though, or you won't have any power left for the antenna. Best for the moment to set the output coupling loop for maximum reading on the distant (10 to 15 feet) detector and beam, and note the grid and plate current.



1215 mc yagi

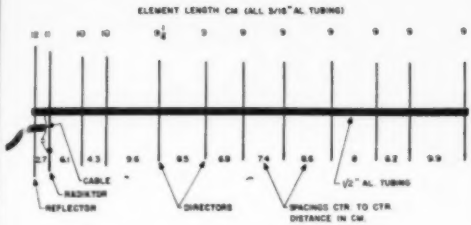
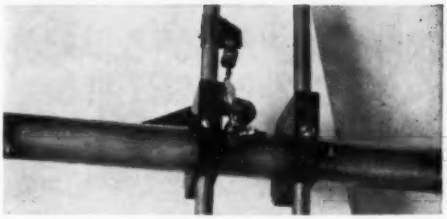


Fig. 10. 1215 mc yagi dimensions.



Gamma match.

1215 mc Beams

Two of these will start you off on 1215. With the transmitter on one beam and the mixer cavity used as a power detector on the other beam, by connecting a 0 to 100 microampere meter in the place of the *if* coil (or in series with it) the meter shows full scale with the beams pointing at each other 10 to 15 feet across the room.

Figs. 10 through 14 show details. Again, make Chinese copies and they will work. They are very handy for getting started. Then you can go creative and try anything you wish using these little ones as standards, test antennas, etc.

There is only one adjustment you should make on these beams. Plug in the transmitter (I used about 10 feet of RG58/U to start (probably makes about a 3 db pad, at least)) and, watching the distant (ten feet) receiver (use a DC cable to bring the meter back near you so you can read it) meter tune the gamma match capacitor with a screwdriver made of fiber, with no metal tip. You can also try a few different spacings, for the reflector only, adjusting the gamma capacitor each time, or leaving a sub miniature fixed 4.7 mmf capacitor there. See Fig. 2. Do not change any of the director spacings. Once again, these little firecrackers are just to start with. All kinds of things can be done later. Skeleton parabolas, four corner reflectors vertically stacked, sky's the limit. At least you now have a low cost, test oscillator-signal generator, two good beams, a low cost receiver, a small antenna range, and you can work across town!

K1QNM took one unit to his shack about half a mile away in Melrose, Mass., through trees, houses, etc., and came in very loud using his beam indoors. My beam was just outside the roof about one foot average above a skylight on the third floor.

Of course, a good deal is to have some local lad near you make up a second complete rig along with yours. How far will these go on mountain tops? You think I should already know? Listen, good friend and reader, fellow 1215'ers are scarce enough! In the cold weather I do circuit work!

I use one beam on the receiver and another on the transmitter, without rf switching, so far. I intend to run a series of 1215 mc tests on cables, connectors, switches, and relays, soon, however, and hope to let you know the results, via 73 grapevine.

. . . K1CLL

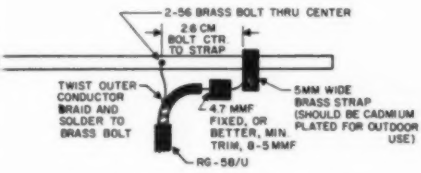

2-56 BRASS BOLT THRU CENTER
2.6 CM BOLT CTR. TO STRAP
TWIST OUTER CONDUCTOR BRAID AND SOLDER TO BRASS BOLT
4.7 MMF FIXED, OR BETTER, MIN TRIM, 0-5 MMF
5MM WIDE BRASS STRAP (SHOULD BE CADMIUM PLATED FOR OUTDOOR USE)
RG-58/U

Fig. 11. Driven element of yagi.

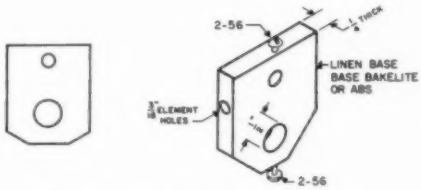


Fig. 12 and 13. Details of yokes.

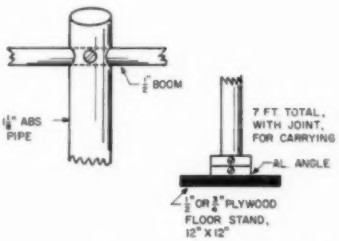


Fig. 14. Antenna mast and support.

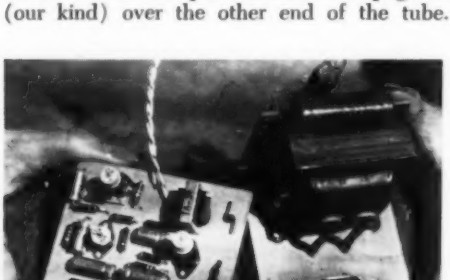
Ken Cole W7IDF
P.O. Box 3
Vashon, Washington

Total Boredom

How many times have I read a "handy hint" in a magazine and thought: "Of course! Why didn't I think of that?" And later, when the ingenious suggestion turned out to be less practical than imaginative: "Naturally! Why didn't I think of that?"

Most often I do this mental two-step to my own tunes. The mechanical facts of life kill off a majority of my inspirations with swift mercy, often leaving a legacy of odds and ends best referred to frankly as trash. Like all these nice aluminum cans that came filled with Red Kettle soup mix—a good product but one I didn't need. In the supermarket these "handy parts containers" stacked perfectly. But not after they had been opened.

On the other hand, some ideas work just fine, but who needs them? And how often? Clip the point from an exhausted ball-point filler and force the empty plastic tube through a hole in a cork. Slip a few inches of spaghetti (our kind) over the other end of the tube.



Chassis. See text.

Put the free end of the spaghetti into a plastic pill bottle filled with water. The bottle cap should have two holes drilled in it—one a tight fit for the spaghetti. Now you have what is known as a "handy air seal." And all you need to make it work is a gallon of fermenting wine in a jug that fits the cork.

Some hints are real time-savers but others, offered with the best of intentions as safety measures, develop corollary dangers which can be at least as lethal as the original hazards. In a recently published article the suggestion was made that a 2.5 mh rf choke in the range of 200 to 300 ma be connected from a transmitter output to ground. In the event the plate blocking condenser shorts, the choke is expected to function as a protective device, grounding the plate potential and blowing a fuse in the power supply. In many transmitters it would be more typical for the rf choke to burn out before the fuse would go. In this event, unless the operator is both alert and wary, someone is likely to end up with a handful of volts. The shock would be psychological as well as physiological for his attitude will have been conditioned by confidence in the fact that he has installed an extra "safety measure". Indeed, this self-assurance may be the immediate cause of his making that last wrong move.

Ready for the "handy hint"? Use model airplane balsa sheets for transistor circuit boards. It's cheap, light, easy to work, ubiquitous, and it floats. With a soft lead pencil you can sign your creations, label, comment and start holes for parts and hardware. You can work resistor and capacitor leads through thicknesses up to a quarter inch with no diffi-

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culty, although it's something like giving a penicillin shot the first time.

I prefer quarter inch because it's strong enough to permit bolting small transformers, chokes and terminal strips. The transformer in the photo is a ten volt doorbell unit used here in a nine volt transistor-experimenting power supply. The completed board was aligned with an identical piece which had been coated with airplane cement, and then it was carefully stepped on. This forced the wiring and other odds and ends into the surface of the lower board, permanently hid the amateur workmanship (no pun) and saved the cost of rubber feet. There are very few surfaces a sheet of balsa will mar.

Splinters and grain are no problem with this wood, and your wife will agree the color of balsa blends nicely with the modern decor she reads about. The light hue provides an effective background for the components in the event photographs are requested by your attorney, 73 or Western Electric, and you will find it gives a certain lift to your circuits. Speaking of lift—when you give up on one of those maddening projects that just will not work, you can hit back by pinning wings to the circuit board and giving it a savage overhand launch into the blue. The natives will wonder for weeks what to make of a glider with an aborted multivibrator piggyback. Lately, to spare a lame right arm, I've been taking my rejects into the tub with me, where they make very avant-garde rafts for my plastic ducks.

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Bill Smith KØCER

Oscar III:

Some observations

"It is up" . . . three words that opened the door to another era of Amateur Radio communications. These are the words that flashed around the world March 9th when OSCAR III completed its first orbit at 1930 GMT.

OSCAR III was launched from Vandenberg Air Force Base and a short time later was reported in a Polar orbit about 500 miles high and circling the Earth once every 103 minutes at a 70 degree inclination.

From my own observations, and those that have been reported to me, the satellite functioned as planned with the exception of the 145.950 megacycle beacon, I did not hear it and I know of no one who did.

However, the well-known, friendly "HI" signal and telemetry beacon on 145.850, plus or minus depending on Doppler shift, was loud and clear.

The transmitting pass-band from 145.875 to 145.925 also functioned well although a few kilocycles lower than planned.

I began tracking on the sixth orbit but did not hear any amateur signals until orbit number 8, although the "HI" beacon was very strong, about 25 db over receiver noise.

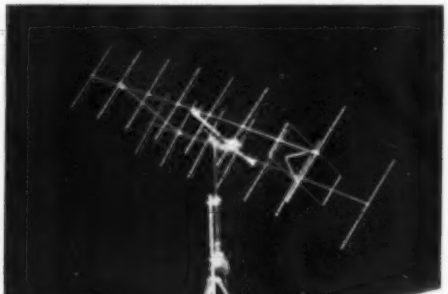
The first amateur signal I could identify because of the QRM and QSB was that of K9AAJ . . . the same gentleman, who along with K2IEJ, made the first confirmed two-way QSO via OSCAR on orbit number 13.

Another contact that may be of interest, although the two stations are only some 360 miles apart, was on orbit number 76. K9AAJ worked KØCER when the satellite was off the southeastern tip of Greenland. THAT is a long way around to work a station 360 miles away!

The maximum distance that I was able to hear the "HI" signal was somewhat over 3,000 miles with 2,500 miles being consistent.

Being located in the midwest puts me in a rather favorable position to hear stations throughout most of the United States. Over 20 states were logged with K9AAJ, K4IXC, K5TQP, K2IEJ, K3KEO, K9UIF, WA6MGZ, and K5WXZ having the most consistent signals.

Now for some observations. These should prove of interest for comparison and I welcome any comments for a later article where some comparisons can be drawn.



KØCER's Oscar III antenna.

1. There appeared to be no difference in signals between north and southbound passes.
2. The "HI" beacon could be acquired usually about 8 minutes before TCA but the largest number of amateur signals were heard immediately after TCA until the abrupt cut-off as the satellite passed out of range, about 2,500 miles.
3. There was a very marked signal increase just before the satellite dropped over the horizon.
4. Horizontal and vertical polarization worked about equally well except during passes that were nearly, or directly, overhead. Vertical polarization and being able to point the antenna at the satellite showed a marked improvement over horizontal polarization.
5. QSB . . . we all cussed this. The QSB was probably THE limiting factor in preventing more QSO's. A signal would be solid copy for about 10 to 30 seconds and then disappear. This was no doubt due to the pitching of the satellite in space and made meteor scatter techniques for information exchange a must. The QSB and the Doppler shift caused many QSO's to be lost. I probably lost seven due to this and I heard any number of fellows miss out the same way.
6. Slow speed CW (I heard only one AM and four SSB stations) would have been the best way to cope with the rapid signal strength variation, but the short duration of the signals forced keying speeds in general of 20 wpm or more. This hampered the "phone-only" operators.
7. The "HI" beacon could be copied on the simplest of receivers but it took a good, low-noise converter/receiver to pick out the ham signals. The ham signals appeared to be only about one-half as strong as the "HI" beacon. The beacon could be copied continually but not ham signals.
8. Buck-fever. I guess we all suffered from this. During the first 75 or so passes everyone was calling CQ. Later the trend seemed to reverse and everyone was listening. Somewhere along the line we are going to have to adjust ourselves to this kind of communication.
9. I know of no station using the OSCAR Association suggested transmitter power of 100 watts. I used 400 watts. This might have had something to do with all the over-all amateur signal strength being less than the "HI" beacon if the translator power was being "used-up" by the high-power boys. Maybe it takes higher power to work through the satellite than was anticipated.

In summary, it would appear the amateur who was an experienced operator and fairly well equipped had the most success. We all learned the fine techniques of satellite tracking, developed our own ideas of what was the best antenna and which polarization to use, and operating procedure. This experience will be most helpful in future OSCAR's and we should see more contacts being logged.

I am most interested in receiving reports from all participating operators and will put the information together for a future article where we can all gain from each others experiences and observations.

And finally, a salute and a thank-you for all the efforts of the Project OSCAR gang, a job well-done, fellows.

. . . KØCER

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	300-F	144-146	28-30	$12.95 ppd.
	300-Q	144-148	14-18	$12.95 ppd.
6M	300-B	50-51	.6-1.6	$10.95 ppd.
	300-C	50-54	14-18	$10.95 ppd.
	300-J	50-52	28-30	$10.95 ppd.
20M	300-G	14.0-14.35	1.0-1.35	$10.95 ppd.
CB	300-A	26.965-27.255	1.0-1.29	$10.95 ppd.
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Letter from Gus

Calcutta, India
March 8, 1965

At this moment I am setting in a small hotel room here in good old Calcutta, India. I keep thinking about Peggy leaving me all to my lonesome on the 11th when she will leave here for home, ICE COLD COKES, hamburgers, Southern Fried Chicken and rice, and seeing those FB Grandchildren! Boy I kind of wish I were going home along with her, but I have promised her I will be home by Christmas—and I HAPPEN to mean it THIS TIME.

You boys want to see a real Ham license—well here is an exact copy of my Bhutan License:—

RADIO AMATEUR STATION LICENSE

Gus M. Browning of Route 1, Box 161-A, Cordova, S. C., United States of America are hereby issued a license to operate an Amateur Radio Station in Bhutan.

He is permitted to use a call sign of his own choosing provided it begins with the letters AC.

It is understood that he will obey the rules and regulations that pertains to the operation of radio Amateur stations, thru out the World.

This license is good for the life of Mr. Browning, no renewal at any time is necessary, of course it may be cancelled by the Government of Bhutan at any time.

THIRD party traffic may be handled with any radio amateur station. Telephone patch may be used at anytime. Dated this 21st. Day of Jan. 1965.

Signed by the
Chief Signal Officer
for the Government of BHUTAN

Now boys ain't this a dandy Ham license? THAT is the kind of license I LIKE!!!

Peggy and I just arrived here from Bhutan, I plan to go back there on the 13th of March. So far I have operated from AC5 and AC8 (12500 Ft up) and when I go back I plan on going to AC9 after another shot at AC8 and if possible even ACØ, when the snows melt and if things are RIGHT and nice and QUIET maybe even even AC4—but you won't hear that prefix ever given—it will just be AC8/ (with NOTHING after the / mark. Of course AC3 is very strong in the plans and this may be the hardest one of the lot to pull off this time. I will be trying and I mean trying VER YHARD, but this one will not be easy. BE ON YOUR TOES BOYS this one may come out of a clear sky without any warning at all. I hope it will be right after the 15th of April.

Conditions have really been stinko. They are the worst I have ever seen. The openings are short and usually weak. My GOOD EQUIPMENT at this moment is still in the INDIAN CUSTOMS here in Calcutta. I have been stuck on Transceive up to now with only 100 watts input. The new rig has 2 VFO's and 300 watts input and getting it thru INDIAN CUSTOMS will be really tricky this time. They want me to get a license from their Ministry of Transport and Communications JUST TO BE ABLE TO TAKE IT THRU THEIR INNER LINE (the Inner line being a strip of land just south of Bhutan, Sikkim and Nepal) I intend to stay here in INDIA until I have exhausted EVERY MEANS of getting this equipment to Bhutan with me. THESE INDIAN CUSTOMS are MEAN—they go by THE BOOK and the book has a lots of very fine print in them—and they are reading EVERY WORD of the fine print this time. I sure hope I get a chance to use this fine lab built gear that Hammarlund built up especially for me. Stick with me boys—I AM A TRYIN' and A SWEATIN' THIS ONE OUT.

CAN SOMEONE TELL ME PLEASE WHAT HAS HAPPENED TO THIS RECIPROCAL LICENSING STUFF? It ain't helped me a bit yet. How about you fellows writing your Senators and Congressmen and ASK THEM WHAT'S BEING DONE on that bill! The bands go out in AC5 at 1300 Z and at AC8 about 1400 Z. EXCEPT for Raju-VU2NRA who is still the loudest thing on the bands ALL THE TIME even when the

con't. on next page

VHF

LATE OSCAR FLASH

It would appear the Repeater is beginning to fail on about orbit 210. On orbits 213 and 214 the "Hi" Beacon was peaking 50 DB over noise but no evidence of any repeated signals although "pings" similar to meteor scatter signals were heard faintly. WØENC at Rapid City, South Dakota reports the battery voltage down to about 18 volts. The last amateur signal heard here was from K2GUG on orbit 201 peaking 25 DB over noise. WØENC reported hearing K9AAJ, WB6KAP and K2GUG on orbit 202 but nothing identifiable after that.

With this issue of 73 comes the initiation of a VHF column. Wayne and I hope you will enjoy and support it because only through YOUR support and interest will it thrive.

A short time ago Wayne asked for your comments on whether 73 should carry some columns on selected topics. Forty per cent of you said you wanted a VHF column in 73 so after the exchange of a number of letters between Wayne and myself he gave me the go-ahead.

It is our intention to aim this column at the technical and construction aspects of the field and it is along these lines we shall move. In doing this, I solicit and welcome ideas, your pet circuit, technical and construction projects, suggestions and criticisms. I realize that a great number of VHF/UHF operators just simply do not want to take time away from their projects to write a finished article. This is where I will come into the picture as your editor. I will take your notes and rough drawings, etc. and put them into finished form so each of us can benefit from the work of each other.

Now a short introduction is in order. I was first licensed in 1955 and after two years on the DC bands, moved to six meters operating from Iowa, Arizona (as K7RIA) and South Dakota. In August of last year I switched to two meters and that is where I operate most every night with 400 watts of CW. I am 25 years old, married, have a daughter and am employed as the news editor of a Sioux Falls radio and television station.

Enough of that, and on with the column.

During the past several weeks the eyes of the VHF world have been focused on a small package of transistors circling the globe once every 103 minutes.

OSCAR III is writing new pages into the history of amateur radio in the space age. What are some of these pages of history? Let's look at some "firsts."

K6GSJ heard the first repeated amateur signal from OSCAR, that of K6UQH on the very first orbit. On orbit six, W8PT heard W4WNH for the first "long-distance" repeated signal. The first confirmed two-way contact came on orbit 13 when K9AAJ and K2IEJ contacted with signals of a meteor scatter nature. The first reported two-way QSO outside of the U-S came on orbit 20 between HB9RG and DL6EZ. Leave it to W1BU to come up with another first. On orbit 19 he heard HB9RT for the first Trans-Atlantic reception of a repeated amateur signal. On orbit 51 KH6UK scored a Trans-Pacific first when he heard WA6MGZ. K9AAJ reported hearing KL7CUH on the ninth orbit. W6NLZ and K2GUG scored the first coast-to-coast QSO on orbit 35 but W1BU seems to have outdone them all. On orbit 61 Sam and DL3YBA spanned the Atlantic for a two-way contact. I also have a non-confirmed report that Sam worked HB9RT also. The above information is accurate with the possible exception of when W1BU heard HB9RT, the orbit number might be wrong because of a garble in KØSZJ's teletype copy. I am sure there have been other similar firsts but I have not received reports of them. How about it, you fellows that were involved? I might also comment that the first two-way contact, between K9AAJ and K2IEJ, was copied here from both stations.

Next month, most of the country should be defrosted enough to think about antennas, so we will cover matching harnesses and beam stacking. While you're thinking about that summer antenna project, look at these figures before you buy your new coax feedline.

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VHF

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RG 17 U	.4	.5	1.1	2.3	66c
RG 58 U	2.0	2.7	5.5	10.5	3c

It is false economy to buy inexpensive coax for VHF applications. Even at 2 meters RG 58 U soaks up nearly 75% of the transmitted power before it reaches the antenna.

Also planned in the near future are articles from WØCTM on 432 megacycle transmitters, tropo dx by WØEMS and so forth.

Please do let me hear from YOU.

Bill Smith KØCER
1301 Churchill Ave.
Sioux Falls,
South Dakota 57103

Gus

bands are DEAD for anyone else. They must have the exact perfect skip for AC lands and VU2NRA lands ALL THE TIME. 40 meters—Ha Ha Ha, boy that's a joke with all those commercials there—and I mean ALL OVER THE BAND too, right down to 7,000 kc, once in a while you might find a 1 kc hole near 7,000 kc. I keep trying on 40 but it really looks like it's a losing battle. I keep trying about 0000 Z until 0130 Z and again 1000 to 1200 Z and also at other odd times hoping it may open up accidently. Don't give up fellows. W8FGX and W8JIN SHOULD COME THRU SOMETIME!!! I did hear a W1 once and one single W6 and that's all as far as the USA is concerned.

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. . . Gus

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Paul Franson WA1CCH

Testing the Davco DR-30

I was skeptical when I read the first Davco ads. You've seen them. The Davco DR-30 is a ham band transistorized communications receiver. That's not much of a surprise. We've all been waiting for one for 10 years. But the DR-30 sounded like a 75A4 crammed into a file card box—and then some! How could they fit all that performance, versatility and reliability into 1/10 cubic foot?

When the Davco arrived, I found out. They threw away the book of old-fashioned conventions on this one. It's the first really up-to-date amateur equipment I've seen. Davco has used modern techniques that are long overdue in ham gear. The DR-30 isn't just an old receiver stuffed into a little box; it's completely new. The first thing you notice about the DR-30 after its small size (4 x 7 x 6) and good looks is how solid it is. It's a heavy handful of high quality parts and state-of-the-art techniques: The "chassis" is a solid extruded aluminum frame with 3/16 inch walls. You couldn't bend it without driving over it. The controls are mounted on cadmium plated steel attached to the extrusion. The circuits mount on eight miniature fiberglass modules mount on eight miniature fiber glass modules that plug into mil spec connectors on the frame. High-Q toroids are used for the rf amplifier and VFO. The *if* transformers are the size of pencil erasers. A Collins mechanical filter, Clevite transfilters and a crystal filter furnish selectivity. In all, 15 diodes, 14 crystals and 25 transistors are used. All parts are high quality and conservatively rated.

Here is a complete high performance communications receiver that is compact enough to use anywhere: mobile, home, portable. It draws less current than a flashlight bulb, so it's economical to use with small batteries as well as in the car or from the power line. Yet the DR-30 offers exceptional performance. It uses dual conversion with a crystal-controlled front end. It covers every kc of the amateur bands between 3.5 and 50.55 mc (as well as 9.5 to 10.05 mc for WWV and two other 550 kc bands of your choice). The RF amplifier in the DR-30 uses high-Q toroidal coils for excellent image rejection and a UHF premium low noise transistor (2N2495). The noise figure of less than three db—even on six meters—and AM sensitivity of better than ½ μv means that you can hear those real weak stations when no one else can. It also means that the DR-30 is exceptionally quiet with no signal. None of that annoying hiss. In spite of all the advantages, transistors have one drawback compared to tubes: crossmodulation. Davco avoids this completely with a very clever trick: The RF gain control is an at-

tenuator in the antenna circuit. There is no loss when it's switched out, but the control provides excellent control action and seems to completely eliminate crossmodulation.

The DR-30 has three selectivity positions for optimum performance under all conditions in all modes. For AM, the *if* cans and transfilters provide about five kc bandwidth. SSB uses a Collins mechanical filter for 2.1 kc. For the CW hounds, there is a very sharp (about 500 cycles) crystal filter used in addition to the mechanical filter. There is very little difference in audio level as you switch between the three positions if your signal is tuned in properly. The audio is properly restricted for communications, yet very clean.

The Davco doesn't seem to drift at all. I varied the input voltage from 11 to 15 volts, dropped the receiver on the desk, took it outside (brrr) and couldn't hear any change in the beat note with WWV. This is partly accomplished by the high stability toroidal oscillator coils, partly by the solid construction, partly by the zeners, and partly by very extensive development of the temperature compensating networks.

The tuning mechanism uses a flywheel with extensive spring loaded split gears for very smooth, slow, backlash-free action. The dial is calibrated to five kc, and the tuning knob to one. Tuning sideband is as easy as tuning WCKY. . . .

The notch filter is very effective in taking out QRM and heterodynes. The 100 kc calibrator is included. One of the real bonuses of the DR-30 is the noise blanker. It's not just an audio noise limiter. It picks up the noise pulses before the selectivity of the receiver lengthens them and uses the pulses to turn off the receiver for the minute duration of the noise. It's very effective in getting rid of all types of pulse-type noise.

The case of the Davco is heavy steel with a hard, scuff and scratch proof textured finish. The panel is HP grey with white silk screened lettering. Knobs are professional black with chrome inserts. Very nice.

Davco has also announced the companion transmitter to the DR-30. It's called the DT-20 and has the same front panel size. The two plug together for complete transceive operation, yet each has a VFO, so the receiver and transmitter can be used on separate frequencies if desired. The DT-20 should be available this summer.

One thing that occurred to me before I used the DR-30 was that the small size might make operation difficult. It doesn't. In fact, I'm impressed with the ease of operation of the receiver. All of the controls are there within easy reach. You don't have to reach all over a huge panel trying to grab the gain control or selectivity. All of the controls have the same solid feel that the receiver itself has. Using the DR-30 is a real pleasure. My first thought was that it would be useful primarily for portable and mobile operation. Well, it's invaluable for that, but it also is the best home station communications receiver I've ever used. It's more convenient, more versatile and works better than those huge old-fashioned heat generators. I compared it to other receivers and converters. It beat them all. On six, the tremendous sensitivity and low noise let me hear many stations I couldn't hear on the well-known converters. And the price! The introductory price of $337.50 is incredible. I don't see how they can make and sell the DR-30 for that. You can even get two for the price of some other good receivers. One for your car and one for your shack. I bet that the Davco will be more convenient, more versatile and work better than the big one, too.

You can see that I'm sold on the Davco DR-30. Try one out. You will be, too.

. . . WA1CCH

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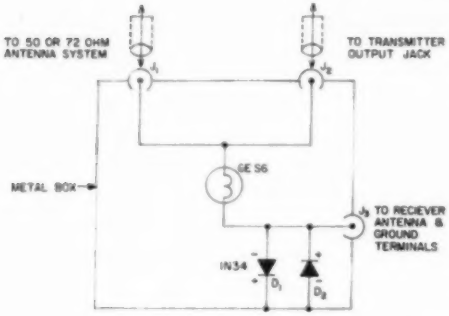

Here is an electronic device that permits instantaneous "switching" of a single antenna from transmitter to receiver. It is simple to build and requires no external power supply. It will handle output up to 500 watts and will also operate on "flea" power such as a Heath Sixer when an outboard converter is used. The only disadvantage found in this unit is that it does attenuate receiver signal slightly.

The unit can be built in a small metal box where all parts can be easily mounted. It should be remembered to use a heat sink when soldering the 1N34.

This unit works very well on both CW and SSB and a single relay can be added and used on AM.

. . . W5ZBC

SEMICONDUCTORS

Paul Franson WA1CCH
73 Magazine

Welcome to the first of the monthly 73 semiconductor columns. I will write this column on the assumption that most types of vacuum tubes are obsolete, so will try to devote a good bit of the column to practical transistors for the average ham. At the same time, I'll try to tell you about the latest developments in semiconductors—even if some are a little beyond the reach of most of us. I'll be happy to hear about what you are doing and what you are interested in. Let me know about the transistors that you use. You may have made a find that none of the rest of us know about. All comments are solicited, but if you ask questions, be sure to include a SASE.

The IEEE show in New York provided the opportunity for visiting a bit with most of the semiconductor manufacturers. They had many new items on display. Many were very sophisticated (and expensive!), but others were quite reasonable and of immediate interest to all hams. One significant trend is to very inexpensive transistors for consumer uses. It's about time; until fairly recently, transistors were used for entertainment only in the ubiquitous portable radio. Hi-Fi equipment was the next field conquered. Now portable TV sets are becoming very popular and the American semiconductor manufacturers are rushing to bring out suitable cheap high performance transistors for TV. Most of these devices are good and inexpensive, but not the ultimate. They'll match a 6BS8 or 6CW4, but not a 416B. The easiest (?) way to make transistors cheap, of course, is to make lots of them. Thank goodness for the broadcast receiver industry. Another way to make transistors cheap is to substitute inexpensive, non-critical, plastic or epoxy cases for the expensive hermatically sealed, environment-proof, mil spec metal cases. Here are some of the interesting new economy transistors:

From GE: Silicon planar economy transistors in a small plastic case about 1/5 x ¼ inch with three inline leads. Bulletin 45.01 describes the line. A few examples: 2N3663 has an f_T of 1100 mc, a "typical" noise figure of 4 db in TV rf amplifier service, and a price of 83c in large quantity. The 2N3721 has an f_T of 120 mc and only costs 20c in quantity. For transmitters, the 2N3405 has 900 mw dissipation, 50 volts BV_{CEO} and f_T of 150 mc. Price is 52c in quantity, and either $1.25 or $2.08 apiece singly depending on where you look.

Texas Instruments has a line of germanium epitaxial planar transistors that promise many ham and commercial applications. Numbers are TIXMO1-08. They are encased in a new glass and plastic package with standard lead arrangement. Prices go as low as 30c. Among the advantages TI claims for the transistors are very low noise figure, guaranteed forward AGC characteristics, low feedback capacitance to eliminate need for neutralization, minimum detuning with AGC, and the package. Incidentally, extensive tests show that the package is very reliable and long-lasting.

Other manufacturers are also working on these economy transistors. Let's hope that they find their way into ham gear in not too long and replace those old tubes. Incidentally, I've been using the fabulous new Davco DR-30 receiver. It's what receivers have been working up to for these 50(?) years. Make sure that you find out all about it; it's a fantastic piece of gear, and considering its features and quality, should sell for twice its price.

Not all of the new transistors are cheap receiving types. TI has a new one (TIXS12) for microwave use. It oscillates up to 2500 mc (2.5 Gc) and puts out ¼ watt at 1.5 Gc. Cost is a bargain $1080! Other new TI transistors are the 2N2876 ($49.50) for ten watts at 50 mc and three on two, and the 2N2631 in a TO-5 case ($33) for 7.5 watts on six.

RCA has the 2N3632, 2N3553 and 2N3375 epitaxial silicon planar types for class A, B and C amplifiers, frequency multipliers, and oscillators at VHF and UHF. The 2N3632 will put out about 14 watts on two in unneutralized class C service.

RCA has also come up with some transistors specifically designed for use in 117 vac broadcast sets without low voltage transformer. Since most radios are used in buildings with AC power, why bother with batteries. The 40261-40264 transistors and 40265 rectifier provide excellent service from a four transistor circuit instead of the standard six transistor line-up of low voltage sets. They are also good in phonographs.

Bendix BIG rf silicon planar epitaxial transistors show a rating of up to 20 watts out at 50 mc. Typical numbers are 2N3619 through 2N3630.

TRW's (formerly PSI) new PT4690 puts out six watts from 28 volts at 400 mc with an efficiency of 40%. At 250 mc, output is eight watts with 8 db gain (1.7 honest watts of drive) and 70% efficiency. Cost is about $38 in 100-quantity.

Write and tell me what you want in the column.

. . . WA1CCH

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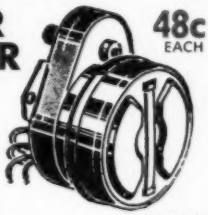

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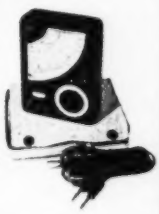

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Jack Bruce WA6UVS
Box 259, Route 3
Carmel, Calif.

The Litts Code Snitcher

A few months back, friend and neighbor Dean Litts acquired for himself a new call, WV6YOV, an almost new DX-60, and an old but suddenly active set of nerves. Shortly thereafter on a visit to observe operations at the new shack I found friend Dean groggy, jumpy and determined as he pounded brass, twitched dials and strained to make sense out of the dits and dahs pouring out of the receiver. He had but one specific complaint, however: the necessity for retuning the receiver each time the QSO was "turned over." Most Hams, of course, will immediately recognize this problem. I must confess I didn't. Starting with a "General" and a sidetone transmitter I have always regarded a code monitor as strictly a gadget for tinkerers—until now. Herein, then, is an accounting of fun and education in designing a surefire monitor for the popular grid block keying transmitter.

There are two main problems associated with designing a good code monitor. First, for a pleasing tone, a good sine wave must be generated; secondly, the sine wave must be keyed correctly and without disturbance to the keying circuits of the transmitter.

I researched the published literature on the subject. One author advocated breaking the grid resistor from ground and inserting the key at this point; this for grid block keying only. This arrangement produced some of the most sickly sounds this side of Doctor Ben Casey. Actually the results are understandable since cut-off of the tube is controlled by the value of the grid resistor through which the blocking voltage must pass; the larger the resistance, the slower the tube is forced into cut-off, and vice versa.

All the other literature concentrated on the principle of rectifying rf from the tank or antenna line and amplifying to either earphone or loudspeaker volume. The trouble with this

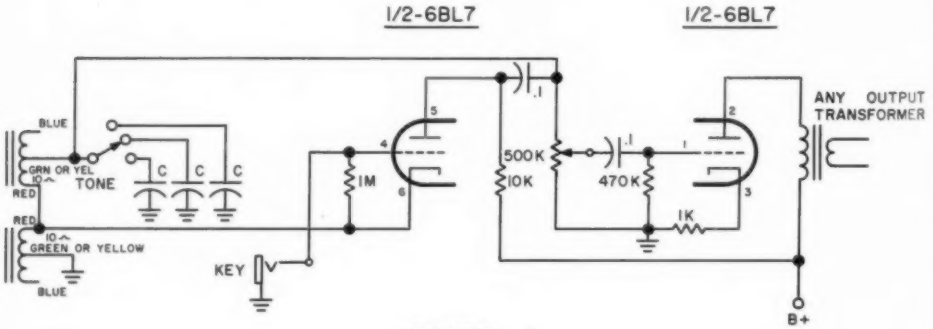

FIGURE 1

latter arrangement is that there are too many loose ends flopping around. For example, closeness of the pick-up coupling loop versus frequency.

Salvation of the situation rested in using a simple LC oscillator circuit in which the grid of the oscillator tube was at ground potential during operation and considerably above ground when in the standby position. This arrangement assured no interference with the transmitter circuits during "key down" and maintained the transmitter final at cut-off with the key up.

Fig. 1 shows the final arrangement of the Snitcher developed after many circuit changes. The final product is as bare of frills as possible. The only difference from a basic oscillator circuit is that the grid is keyed to ground, while the inductance coil feedback tap is connected to cathode and is above ground.

The grid resistor performs two purposes. The first is naturally to bias the tube. The second purpose is to keep the grid block voltage of the transmitter at approximately its original value before attachment to the monitor. Something between 100K and 1 meg will suffice. Actually the best waveform, and consequently the best tone, is obtained with a very low value grid resistor, but unless the monitor is to be used exclusively as a code practice oscillator, anything less than 100K will be impractical. The tank capacitor should be chosen to suit the ear of the user; decrease it for a higher tone and increase for a lower one.

The inductance coil (L1) is the chief source of the good waveform. Almost any two coils of approximately the same inductance will work if connected in series. My unit worked quite well using two television vertical output transformers. These are readily available from old receivers. Select those of the auto-transformer type and choose two whose resistance between two of the leads is 10 ohms or less. Connect them as shown in Fig. 1 and wrap off the other two leads. It will be necessary to try a variety of tank capacitors to find the right combination because the inductance of transformers will be unknown.

The nicest thing about these devices is that they almost always work; the fun lies in making them work better.

Dean Litts no longer grumbles amid his dits and dahs; his Snitcher stays with him wherever he moves.

. . . WA6UVS

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LO LEVEL?
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New Books and Literature

TMC SSB Handbook

In 1962, the Technical Material Corporation began a factory training program for their field engineers and customers. Out of this program grew the *SSB Handbook* by William P. Henneberry. This book covers the field of SSB carefully and completely. It was designed as a textbook, so is ideal for home study by novices and a reference for experienced engineers. Chapters: Introduction to SSB, Review of AM, Elements of SSB, Types of SSB Operation, Nature of SSB Signals, Distortion in SSB Transmitters, Balanced Modulators, Linear Amplifiers, Filters, Frequency Synthesis, SSB Receivers and Converters, The *SSB Handbook* is hardbound with 210 pages and many photos and drawings. Price: $10. TMC, 700 Fenimore Rd., Mamaroneck, N. Y.

Zeus Catalog

The Zeus Portable Generator Co. has released a new comprehensive general catalog of its alternator-type electric power generators and accessories. A total of 14 different models from 1000 to 300 watts, including two new propane powered items, are listed. The catalog also describes describes 12 new accessories and options. All of Zeus' power plants are built around a permanent magnet alternator with only one moving part. This reduces weight and reliability considerably over conventional generators. Zeus also has available a series of charts showing the power required to operate various tools and appliances. Write to Tom Creighton, Zeus, 12435 Euclid Ave., Cleveland, Ohio.

Charts and Nomographs for Electronics

Solutions to hundreds of electronics math problems the easy way can be found in the new *Charts and Nomographs for Electronics Technicians and Engineers* by Donald Moffat and published by Gernsback. It will save you time and effort in any problem in every field of electronics. All you have to do to find a solution to your problem is turn to the proper page, slide your ruler in place and read the answer. You don't have to mess around with a slide rule or wear out your brain. Examples are even provided for each chart. The book is a large 8½ × 11 and is spiral bound to lie flat. It contains 96 pages and costs a reasonable $5.95. Gernsback Library, 154 West 14th Street, New York City.

Cush Craft Catalog

Cush Craft has out an attractive new catalog listing all of their amateur antennas and accessories. Included are yagis for 20 through 432, portable beams, collinears, Squalos, Big Wheels, halos, Twists, and ground planes. Make sure that you get this catalog from your distributor or from Cush Craft, 621 Hayward Street, Manchester, N. H.

1965 EICO Catalog

The new 1965 EICO short form catalog features many new EICO kits. EICO has many kits in the Hi-Fi, service and general fields of interest to most 73 readers. The ham gear is particularly interesting. A new item is the only three band SSB transceiver kit. In all, over 90 items are fully described in the 48 page catalog. You can get you copy at your local distributor or from EICO at 131-01 39th Avenue, Flushing, N. Y.

Sams Transistor Spec Manual

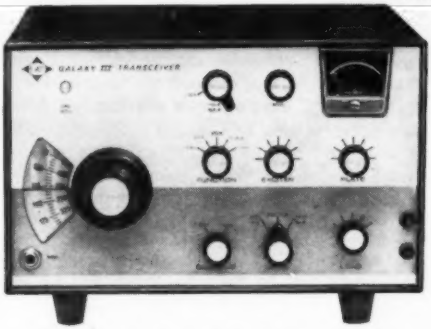
You don't have to work with transistors very much to find an interesting fact: unlike the popular tube manuals put out by manufacturers, transistor manuals usually list only those transistors made by the company. Consequently, it's often very hard to find data about a specific transistor. The new Sams *Transistor Specification Manual* gives complete electrical specs, basings and outlines for over 3500 transistors. A useful section lists older transistors with new type numbers. If you work with semiconductors, you need this book. $2.95. Available from your distributor or from Howard Sams, 4300 W. 62nd St., Indianapolis, Ind.

GE Tube Manual

The eleventh edition of General Electric's *Essential Characteristics*, a digest-sized 326 page manual is now available. It contains a wide range of information on receiving tubes, special-purpose tubes and some other GE products. The manual provides information on virtually any tube you're likely to run into. One of its special features is that the basing diagrams are arranged across the separately-hinged bottom portion of the pages so that data on any tube can easily be matched with its base. *Essential Characteristics* is available from distributors or by mail for $1.50 from GE, Dept. B, 3800 N. Milwaukee Ave., Chicago, Ill.

EDWARDS ELECTRONICS whose personnel includes
WA5EIY...WA5EDE...W5FYX...W5MZR...
W5KFT...WA5ISW...K5MPA...

RECOMMENDS



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New Products

Ham TV Camera Kit

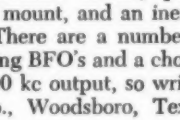
There's no excuse any longer to put off getting on ham TV. ATV Research has done the difficult part of the work for you. Their model 65A Focus-Deflection Coil Kit furnishes all of the special hard-to-make parts for your camera. Included are machine wound focus and deflection coils, shielding materials and a shielded vidicon target connector. Assembly of the coils takes less than one hour. Included with the kit is a 16 page Vidicon Camera Construction Manual with complete instructions for building a straightforward 5 tube TV camera that uses standard, economical parts. Price is $16.95 ppd. Write to ATV Research at P.O. Box 396 in South Sioux City, Nebraska, for more information.

Design Furniture

Are you tired of having to leave your beautiful ham gear on an old table in the basement because your unesthetic wife thinks it's ugly and won't let you bring it upstairs? Design Industries has come out with the solution to your problem. They make beautiful wood-finished equipment consoles that will soften the hardest wife's heart. The furniture is on casters, the front panels are easily replaceable for new gear, and the doors have locks to keep out sticky fingers. Our photo doesn't do them justice; get an attractive four color brochure from Design Industries, P.O. Box 6825, Dallas, Texas.

Tunaverter

No, there's nothing fishy about this one. It's Tompkins Radio Products' tunable converter for any single ham band (or special frequencies). The Tunaverter uses vernier tuning, tuned antenna circuit, printed circuit board, gimble mount, and an inexpensive nine volt battery. There are a number of different models including BFO's and a choice of 262 kc, 455 kc and 800 kc output, so write to Herbert Salch and Co., Woodsboro, Texas for more information.



New VHF Converters

Scientific Associates has brought out some new VHF transistorized converters. One is crystal-controlled and covers any one-mc segment from 108 to 170 mc. The other is tunable over a band of frequencies in the range. Both models include audio squelch, a tuned rf stage, and a tuned mixer and feature instant switching from regular BC to VHF. Size is only 5 x 3 x 2½". Price is under $40. Scientific Associates, P.O. Box 1027, Manchester, Connecticut can send you more information.

New 2 Meter Antennas

Hi-Par is making some interesting new 2 meter antennas. One is a halo that is three half-wavelengths long. Two of the half wavelengths are in phase and the other provides matching. Use of the extra section provides gain over a single ring halo. The other antenna is a two meter quad. It is completely factory assembled so that you only need to open it up and tighten a few nuts for use. Sounds good for portable operation. Contact W1LKQ at Hi-Par, 347 Luenburg St. in Fitchburg, Mass., for more information.

73 Books

Peterborough, N.H.

1—CARE AND FEEDING OF HAM CLUBS—K9AMD.—Carole did a thorough research job on over a hundred ham clubs to find out what aspects went to make them successful and what seemed to lead to their demise. This book tells all and will be invaluable to all club officers or anyone interested in forming a successful ham club. **$1.00**

2—SIMPLIFIED MATH FOR THE HAM-SHACK—K8LFI.—This is the simplest and easiest to fathom explanation of Ohm's Law, squares, roots, powers, frequency/meters, logs, slide rules, etc. If our schools ever got wind of this amazing method of understanding basic math our kids would have a lot less trouble. **50c**

3—REVISED INDEX TO SURPLUS—W6WKM.—This is a complete list of every article ever published on the conversion of surplus equipment. Gives a brief rundown on the article and source. Complete to date. **$1.50**

6—SURPLUS TV SCHEMATICS.—You can save a lot of building time in TV if you take advantage of the real bargains in surplus. This book gives the circuit diagrams and info on the popularly available surplus TV gear. **$1.00**

7—AN/ARC-2 CONVERSION.—This transceiver sells in the surplus market for from $40 to $50 and is easily converted into a fine little ham transceiver. Covers 2-9 mc (160-80-75-40 meters). This booklet gives you the complete schematics and detailed conversion instructions. **$1.00**

12—CW—W6SFM.—Anyone can learn the code. This book, by an expert, lays in a good foundation for later high speed CW ability. **50c**

14—MICKEY MIKER—WØOPA.—Complete instructions for building a simple precision capacity tester. Illustrated. **50c**

15—FREQUENCY MEASURING—WØHKF—Ever want to set yourself up to measure frequency right down to the gnat's eyebrow? An expert lets you in on all of the secrets. Join Bob high up on the list of Frequency Measuring Test winners. **$1.00**

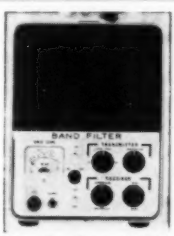
RECEIVERS. K5JKX.—If you want to build a receiver or to really understand your receiver, this is the book for you. It covers every aspect of receiving in author Kyles usual thorough manner. **$2.00**

ATV ANTHOLOGY. WØKYQ and WA4HWH.—A collection of the construction and technical articles from the ATV Experimenter. Includes a complete, easy to build vidicon camera and 50 other projects. The only book available about ham TV. **$3.00**

PARAMETRIC AMPLIFIERS. WA6BSO.—Parametric amplifiers are probably the most practical way for hams to get a low noise figure at VHF and UHF. This book is the only one available that covers both theory and practice. **$2.00**

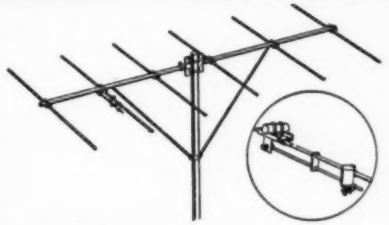
TEST EQUIPMENT HANDBOOK. W6VAT.—Every ham needs to have and know how to use test equipment. This book tells you how to make valuable ham test gear easily and cheaply. It also covers the use of test equipment. **50c**

HAM-RTTY.—This is the most complete book on the subject. Written for the beginning TT'er as well as the expert. Pictures and descriptions of all popular machines, where to get them, how much, etc. **$2.00**



Babcock Band Filter

Babcock has announced the new Model B-3234 Solid-State Band Filter that is used to improve performance of existing transmitters and receivers. It increases the talk-power of SSB transmitters by up to 12 db while reducing the transmitted bandwidth. Speech intelligibility is improved to aid in penetrating heavy QRM. When receiving, a steep-skirted adjustable bandwidth mechanical filtering system removes QRM that a fixed selectivity receiver would pass. T-R switching is automatic. Only three connections to your equipment are necessary: transmitter mike jack, receiver headphone jack and transmitter accessory jack for switching. A 455 kc SSB output jack allows the units to be used as an SSB generator. AC and DC power supplies are provided. $319. L. E. Babcock and Co., 85 Nob Hill Drive, Framingham, Mass.



Long John for Six Meters $34.95

FEATURES

- **Designed for maximum forward gain.**
- **Gamma Match for co-ax feeder.**
- **Finest grade aluminum tubing.**
- **Exceptionally strong since there are no drilled holes.**
- **All aluminum construction eliminates electrolysis.**
- **Entire beam and supports can be grounded for lightning protection.**

We are proud of this new Long John Antenna. We've tried to put in every feature you could want. The result is a reasonable cost high gain beam which can easily be put up and which will stay there practically forever. It has a wide enough lobe so you don't have to swing it around all the time, yet gives you tremendous gain where you want it.

AT YOUR DISTRIBUTORS OR WRITE DIRECT

HI-PAR Products Co.

FITCHBURG, MASSACHUSETTS

Letters

Sic

Mr. Green Attn.:

In pertaining to your article of November 1964 concerning our Kentucky DXpedition on page 90, I would like to comment that one certain sentence is a low down dirty lie deliberately defaming my character!

The article stating that I was kicked in the slats *IS NOT TRUE* and is a willful deliberate lie and there are witnesses who can prove this fact!

It was Alan, not I, who instigated that incident on our trip and he was the one who got into a fight and not I!

I don't know how that article got into that editorial but I have a pretty good idea who did it. Alan's picture is on the far right!

In the first place, the Hammarlund Co. put a ****** ****** in charge of the trip by the name of Alan Day K8ITM! And the trip should never have got started!

I hate to do things like this Mr. Green, believe me, but my reputation is at stake here and I am *not* the troublemaker that Alan is!! Believe me I was in strong debate as to what to do about this and several friends of mine told me I should write you about it! They told me I would be a fool if I didn't!

You don't know half the story about that trip pertaining to the things Alan got away with and tried to get away with! i.e., trying to get me into trouble with the law!! Furthermore he was going to blame it all on me!!

I wanted to back out of the deal since I heard some bad things about Alan but he and his father *forced* me to go!! They are from Canton, Ohio.

I *Demand* a retraction and rectification of that false statement printed about me, I *demand* that *you give* me a *free* copy with that rectification in a later issue of 73 within the next couple of months! I *Demand* my share of the royalties printed in that article since Art and I did most of Alan's dirty work!!

If *you* do not wish to cooperate with me I shall *sue you* personally Mr. Green and I mean business!! *People just don't like lies printed about them no matter what the cause may be!!*

How would you like it if you were the object of a character defamation?? This hurt me whether you know it or not Mr. Green! But anymore it seems that people don't care who gets hurt! I would furthermore advise you to pre edit any further material you print. I also would like to assert that for the most part these people were most congenial, hospitable and much more honest than Alan! In conclusion after doing most of Alan's dirty work Art and I didn't even get to use the rig!!

Paul D. Keller K8EJN

Dear Wayne,

This is an emergency. *Popular Electronics* sent a petition to the FCC for a codeless ham bands to get the rag chewers etc. off 11 and put them on 2 meters. This would be a Communicators License according to *P.E* For reference see January and November *Popular Electronics*. Please let me know how this strikes you. It strikes me sickening. We're losing enough frequencies now without having to lose our VHF frequencies.

Darwin Hansen WAØHAY
Belmond, Iowa

You are absolutely right Darwin, we don't want any codeless hams on our bands. All of us had to suffer through that process and we want everyone else to have to go through the same thing. Sure, I know, half of the active hams never have to know the code once they get their license . . . but just think, suppose we had a war and all the Teletype machines and microphones were destroyed . . . we wouldn't be able to communicate without code. Let's keep that there code.

Hi Wayne—

I have a question for traffic handlers—so wonder if you can throw this one into the mixer and see what comes out?

Before you read this partieular question I'll have to say I can't really sign it—if I do I'm a disgruntled op and so—or a rat fink—or disloyal (to who? I mean to whom—or do I?) So, if you don't think anyone can shed any light on it, throw it into the round file (like some of the traffic). By the way, I wrote another leading magazine this same tale of woe and I didn't see it in print—(I guess because I didn't sign that letter either) I'm a subscriber to the two leading magazines—73 (see, I put you first!!!) and QST. (Don't take offense, Macy's motions Gimbels) That third mag I let go, it was too wishy washy.

Okay, I'll get down to my state of puzzlement.

That BPL list that comes out in that other magazine? Are they all one operation stations? This is something I can't possibly understand and I wish some one could help me figure it out. I'm the kind of a person who checks the electric co bills and the oil bills to make sure I'm being charged the proper rates. (only about once a year, tho)

For instance, let's start at the top of the list for the month of December—here's a station with a total of 9802 pieces of traffic—originations 544—Rec'd 4669—Rlyd 3797—Delivered 792.

First I figured out the time values (estimated, of course) for delivered traffic. I have delivered traffic—most messages have no phone numbers so you look them up or call information—most of those with phone numbers are wrong anyway, so again you look them up for call information—when you finally get to call them it takes time to dial, half the time there's no answer or it's busy—finally you get an answer, explain yourself, deliver the message, accept thanks, sometimes you have to wait and be told what a wonderful thing to do—average 4 minutes per message, total time 52.8 hours for 792 messages. (and if you can't reach them you must write it up and mail it)

Next originated—even a service message takes at least 2 minutes to write up. When someone calls with a message it takes anywhere from 5 to 10 minutes after introductions, finding the correct address, thinking just what to say—let me be generous again and say 4 minutes per—39.3 hrs for 544 originations.

Now, Received & Relayed. Good clear band, lots of power, no QRM, no breakers (who may be in the same town tfc is going to), standard texts (very small percentage and should be counted as 'book' traffic, anyway, and usually isn't), necessary fills, possible discussion about garbled name or address—lets say 3 minutes per, 4669 & 3797 messages total 423.3 hrs. This comes out to an estimate of a possible operation time of a Grand total 515 plus hours per month, broken down to 30 days for the month of December means 17 hours of full operating time (I allowed one day off for Xmas)

As I look at this awesome total I begin to wonder—does one have time for such everyday good health habits as eating and sleeping, etc, or daily necessities like food and family, or a simple little headache, or separating & sorting messages to reroute them in the proper direction to their destination? Then after all that is done, how does one sort time and count them without collapsing from mental and physical exhaustion?

Y'know, if someone gave me 9802 dollars in one dollar bills I'd take their word for it and not count it! How does one count all those Recd & reld, Recd & Delvd, Rcvd & QTA, Orig. Me oh my! It takes hrs. And where does one store these for a whole year?

I checked the call book to see where that station is and I looked on my road map and it isn't even listed although I finally determined it is near a very large city area. Still, 792 messages are a heck of a lit of messages for delivery from one station in one month. Forget I wrote that—I'm too rotten a typer to rewrite this and my two fingers are about worn out.

So, you see, that's my question????? Using this top station as an example, can this possibly be done by one operator?

Didn't that operator go Xmas shopping or send out Xmas cards?

L. T.
Ann Arbor, Mich.

Dear Wayne:

I have just finished reading "The Amateur and Civil Defense Emergencies," page 58 of the February edition of 73. We need more of this type of article to motivate amateurs toward emergency service. I am in the military and a member of MARS and know only too well what an emergency is and what a backup means of emergency communications can do. I have been in the amateur service the last five years: I am sorry that I didn't think of it sooner. I also have over twenty years in the communications business.

I have a few remarks to make after reading Homer Gaston's (W5CZ) article. I found it very well written, especially concerning RACES, etc. Why can't a frequency or frequencies within the amateur bands be designated for an emergency? Let's say 10 kc or so on the lower or upper end of each band be reserved for emergencies. This is only an idea, and comments are invited. How about a system such as the Marine service uses? Whatever is adopted as far as amateurs are concerned would be an improvement and I believe would greatly benefit the amateur service as far as the public is concerned.

In reference to the ARRL's recent proposals, I do not altogether go along with them, but I do believe we should make a change of some sort, such as eliminating the novice and technician license and making some provision for training only in the one watt class. Some Europeans have this system, and it works real well. In reference to CB, made by Mr. Gaston, I do not believe CB will ever be able to replace amateur radio as an emergency service.

In closing, I would like to say, "Wake up, amateurs! Don't sit back and let the C.B.'ers do your job. We are a special brand of radio men, so let's prove it to the nation and to the world!"

Walter Evans WØASH/DL4PJ
Wurzburg, Germany

Sir:

I know it is more or less useless to write ARRL about this matter. Would be of no use anyway.

My problem is this. ARRL specifies a certain size envelope to be sent to their QSL bureaus. This envelope is of such a size that 1/3 or more is excess and unnecessary. So what does the P. O. do? They fold over the excess, causing the envelope to split open quite often. The recipient of the split envelope never knows if he received all the cards the bureau put in. I very often receive envelopes from the bureau where the envelope is completely in two parts and tied together with string.

This is not necessary. The high up "Fathers" at ARRL-that-have-charge of setting policy on envelopes to be sent to the bureaus should decide on an envelope size 5" x 7" and have the QSL bureaus turn the envelope up the narrow way with flap open. Further, an envelope this size will take all QSL cards except very unusual ones and you would receive your envelope intact from the bureaus.

I'll never know how many rare QSL's I have lost to the P. O. in transit in those number 10 envelopes.

Leander J. Smith W7UVR
Kennewick, Wash.

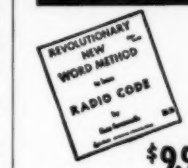
Dear OM:

Why doesn't someone publish a breakdown book on military surplus. There's more and more new stuff coming up all the time, but what is it and what is it good for? No one seems to know but maybe the guy that is peddling it and in a lot of cases even he doesn't know anything about it but price.

Sam Main WØHQW
Grand Rapids, Minnesota

Sam, I've been trying to tell you the book you described for three years now. Our Index to Surplus lists every piece of equipment that has been written up in any radio magazine and is quite up to date. $1.50 from 73, Peterborough, N. H.

LEARN RADIO CODE



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CALL LETTER DOOR MATS

Personalize the QTH with your own call letters permanently molded in a rubber door mat. Made in four (4) colors, red, blue, green and black, large 18" x 28" size.

$5.98 — prepaid, specify color

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190-550 KC. This is the famous Q-5'er! Excel. $14.95
3-6 Mc. Excel ..$14.95 6-9 Mc. Excel . $14.95
100-156 Mc. Excellent cond. Terrific buy! 22.50

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2.1-3 Mc. New ..$7.95 4-5.3 Mc. New . $7.95
3-4 Mc. Excel .... 8.95 5.3-7 Mc. Good .. 4.95

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HS-23 HEADSET: 4,000 ohms. New $4.95
HS-33 HEADSET: 600 ohms. Brand new $5.95
T-17D CARBON MICROPHONE: Brand new $9.95
RS-38 CARBON MIKE: With coil cord and PL-68 Plug. Brand new and bargain buy! $9.95

COLLINS ART-13 RADIO TRANSMITTER

2-18 Mc. 100 W. output. This is the famous one! Excellent condition. A terrific buy at only $49.50

ARB COMMUNICATIONS RECEIVER

Mfg. by RCA. 4 bands, 195 Kc-9 Mc. Excel. $24.95

BC-348 COMMUNICATIONS RECEIVER

200-500 Kc. AND 1.5-18 Mc. in 6 bands! Like new. Checked out—and guaranteed! $89.50

R-105/ARR-15 RECEIVER

1.5-18 Mc. Has 2 Collins PTO Oscillators! Excel. cond $59.50

RECEIVER SPECIALS! PRIDE OF THE NAVY!

Checked out. Guar. w/AC Power Supplies!

RBA: 15-600 Kc. Direct reading freq. dial $95.00
RBB: 600 Kc—4 Mc. Direct reading freq. dial $75.00
RBC: 4-27 Mc. Direct reading freq. dial $95.00

WE NEED EQUIP.—HIGHEST $$ PAID!

We will pay top dollar if you will write us IMMEDIATELY! We urgently want: BC-160 (models H and I preferred), SP-600, R-388, R-390, TED, TCS, TRC, CV43/APR-9, TN-131/APR-9, ARC-34,-52. Test Equipment, Aircraft Comm. Equip., GRC, PRC, ALL SG Signal Generators. We pay freight!

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4365 WEST PICO BLVD. LOS ANGELES CALIF.

World's Finest VHF Ham Shack for Sale.

High up on Mt. Monadnock, the highest peak in southern New Ham Shire, is one of the most exciting VHF locations you could ask for. The installation consists of a six room house, newly painted and newly roofed, all wood paneled inside, four acres of ground . . . the only private property on the mountain, all conveniences, five radio towers, the highest being 120 feet, beams up for 29-15-10-6-2-220-432 and a dish for 1296. Complete with ham gear if you like . . . receivers and converters for all bands up through 432 . . . transmitters for 75-40-20-15-10-6-2. Good solid kilowatt on two meters, mod by pp 4-400's. 288 elements on two meters. No TV sets for over a mile in any direction and darned few for several miles. 20 kilowatts of town power. 1½ mile private road to house kept up by sight-seeing conscalonaire nearby (who also protects house when unoccupied). Price $21,500. Over 2000 feet up the mountain . . . breathtaking view. Will sell only to a ham.

Wayne Green W2NSD/1, Peterborough, N. H.

WANTED

MILITARY SURPLUS UNMODIFIED:
ARC-27, ARC-34, ARC-38, ARC-52, ARC-55, ARC-57, ARC-73, ARC-84, R-540/ARN-14C, ARN-18, R-220C/ARN-21, APN-22, APR-13, APR-14, ARR-41. COLLINS 51X-2 RECEIVER, 17L-7 TRANSMITTER, 51V-3, 51Y-3, 618S-1. **RECEIVERS** R-390, R-390A, R-391. RT-66 THRU RT-70/GRC., R-108, R-109, AM-65, RT-77/GRC-9, GRC-10, GRC-19. **TEST EQUIPMENT** WITH ARM, SG, URM, UPM, USM PREFIXES. COLLINS KWS-1.

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WRITE, WIRE, PHONE (813) 722-1843,
BILL SLEP, W4FHY, EXPORT DIVISION
SLEP ELECTRONICS CO.
DRAWER 178, ELLENTON, FLORIDA 33532

6146B

Dear Wayne:

I've been reading 73 for almost two years now, and I don't thing I've ever seen an RCA ad yet. The back cover of every QST has one—I don't know about CQ; never touch the stuff—but none in 73. I was somewhat astonished, therefore, when you paid for a full-page RCA ad, and a misleading one, at that.

I am referring, of course to the article "Easier Higher Power" in the March issue. This article contains nothing that the RCA full-page 6146B advertisements do not.

Why do I call it misleading? Think of the power gain in decibels and you will see. The db formula is 10 log (P2 ÷ P1). This works out to a power gain of 10 log (1.33 ÷ 1) db or, at the most, 1.25 db increase. At six db per S-unit, this comes out to .28 S-units higher than using plain old 6146's. And although the power gain will increase when you use two or more tubes in the final, the ratio of powers, and thus the S-unit increase remains the same. I'll stick with my 6146.

Mike Prager K1VSI
Providence, Rhode Island

They'll never advertise now.

Dear Wayne:

Now here's a thought that just might make you some money.

There is an impression in ham circles that the 6146B is an RCA exclusive. This is mostly because of the power of advertising—let's face it—on the back page of you know where.

I was recently at a meeting with some people from the Sylvania factory, and they were very sensitive about the fact that people in the commerical field didn't seem to be aware that Sylvania made a 6146B which Sylvania claim is even better than the RCA version.

The article by K9FWF tends to perpetuate the myth of RCA exclusivity.

I suggest you approach Sylvania with these facts, and show them that a series of full page ads in 73 devoted exclusively to the 6146B and possibly some of their wonderful new frame-grid tubes with fantastic Gm, might off-set the unfortunate impression which RCA has managed to create.

Bob Eldridge VE7BS
Vancouver, B. C.

Dear Wayne:

Enclosed is a postal money order for my subscription. Hope it's in time for the mailing of the February issue, 'cause even as good as 73 is, I'm tired of driving a hundred miles for a copy!

I don't know when I've enjoyed a magazine so much. Your staff is to be complimented for being able to draw together so many interesting and informative articles. With my strong interest in building, but with limited ability to understand, I find a wealth of ideas expressed in language which doesn't take a degree in engineering to follow.

The purpose of this letter is not to knock things (or publications), but I can't help but note how nice it is to see a magazine *not* made up of monthly traffic reports, contest results, and such. Keep it up!

Merton D. Short W4JRJ

Dear Wayne:

Your very fine magazine came to my attention last December. Might I mention a few features of 73 that I find to be outstanding: Heavier paper stock; glossy finish; articles not continued at the end of the magazine; page to price ratio (Feb. CQ 28 pages shy, QST 1 page); opens and lays flat while reading or building; items like "The Callbook Game" . . . more!; the editorial is worth the price of the issue on its own merits; but above all I appreciate the well written features, the lay-outs and the up-to-the-minute information in regards to the amateur ranks. Some other points that enhance 73 are: authors full name and address given; advertising mixed throughout the magazine with the articles; most articles written, tested and explained by hams.

Joseph Gaudet
Haverhill, Massachusetts

Dear Wayne,

Many thanks for the fine articles you publish in 73. This is one of the most progressive magazines for amateurs that I have seen. I am a so-called "Charter Subscriber" and will continue to renew because of the fine contents of 73.

I have some info on telephone toroids that might be of interest to the Teletype gang. The list gives the WECO part or coil numbers, inductance in millihenrys (with the coils connected series aiding) and resistance of each coil per line winding (½ total resistance wired series aiding).

Toroid #	Inductance	Resistance per Line Wiring (ohms)
632	.088	4.2
638	.044	2.3
639	.022	1.1
641	.044	2.8
643	.135	4.5
644	.175	6.3
645	.250	9.4
651	.044	3.8

Also Wayne, I have the resistance and impedance ratio of the 120 series Repeat Coils. They are quite nice for patching and matching.

Repeat Coil #	Term 1 & 2	3 & 4	5 & 6	7 & 8	Impedance Ratio
120C	7.8	5.5	7.8	5.5	1 to 1
120D	12.7	5.5	12.7	5.5	1.5 to 1
120E	5.0	5.5	5.0	5.5	1 to 1.5
120H	7.8	5.5	7.8	5.5	1 to 1
120J	12.7	5.5	12.7	5.5	1.5 to 1
120K	5.0	5.5	5.0	5.5	1 to 1.5

I hope this info can be of use to you and the group. I have a quantity of the 632 88 mh and 638 44 mh coils in stock if for any of your future Teletype articles you would like to have a known source to mention. 50c each for the 44 mh and 75c each for the 88 mh.

W. O. Depelheuer W6GTE
R R 1 Box 145
Ellisville, Mo.

Dear Wayne,

I would like to take this opportunity to voice my approval of your battle against the "Powers That Be" in Newington. RM-499 is just so much QRM plus QRN and I feel it is now entering the QSB phase—I hope. ARRL appears to be working two ends against the middle. It seems obvious that with RM-499 at one end, they are attempting to eliminate many fone operators for the benefit of a few, while on the other end they are sponsoring all kinds of aids and encouragements to induce newcomers to hamdom. They cry loudly for "upgrading" to "preserve" our frequency privileges which of course means they think us hams should knuckle down and delve into all the theory books we can get our hands on, or get the heck off the air! But on the other end again, they are supplying books saying how easy it is to become a ham. A glaring example of their inconsistency is the cover of their latest edition of the "Radio Amateur's License Manual." A large illustration on the cover indicates *"all you need to know—in a nut shell,"* while in the the background is shown a group of what purports to be real solid study books—but ARRL puts a big black cross on these to indicate they are not needed—no—just buy their License Manual for 50c and you're in business!

WB2FKZ
Ballston Spa, N. Y.

Dear Wayne:

At the time I submitted the original manuscript for my article, "Improved Halo Mount," which appeared on page 84 of the March, 1965, issue of "73," I was still plugging up the mount with an old champagne bottle cork whenever going through the automatic car wash. Hesitating to mention this I made no specific recommendations. In the meantime, however, I found a standard size crutch tip caps the mount nicely whenever the antenna is removed. They're cheap and readily available at most hardware stores in both black and white.

Jack Ayres K3JZH

DIRECT TUBE REPLACEMENTS
NO REWIRING NECESSARY
JUST PLUG IN—OUR ITEM SA
REPLACES THE FOLLOWING
5Y3, 5U4, 5Y3G, 5Y3GT, 5V4, 5V4GT, 5AU4, 5T4, 5W4, 5Z4, 5AW4, 5V3, 5AS4, 5AX4, 5AZ4
At Least 30-60V more B+ and Current Capabilities up to 1 Amp.
PRICE: $1.95 ITEM SA

DIRECT 5R4 REPLACEMENT
ITEM SC
Replaces 5R4, 5R4GB, 5R4GYB, Compensation network built-in.
PRICE: $3.95 ITEM SC

STUD MOUNT SILICON TYPE 1032
All 5 amps.

200-400 V	price	39c ea.
400-600 V	price	49c ea.
700 V	price	69c ea.
800 V	price	84c ea.
1000 V	price	$1.99 ea.

POWER TESTED SILICON RECTIFIER UNITS
(1 amp. @ 1 ma. max. leakage)

50—200 PIV	price	6c ea.
200—400 PIV	price	14c ea.
400—600 PIV	price	24c ea.
600—800 PIV	price	36c ea.
800 or better	price	44c ea.
1000 PIV	price	54c ea.

AERIAL WIRE
Reel contains approximately 138 feet of phosphor bronze, no. 16 stranded, 200 lb. test antenna wire. Has galvanized clips on ends. Brand new. Shpg. Wt., 3 lbs.
Cat. No. S-6313 $1.50; 4 for $5.00

SUPER PRO POWER SUPPLY
Rack Mounted Excellent condition.
Shpg. wt. 60# Price $19.95 S-6609

TUBULAR HIGH CAP. ELECTROLYTICS

cap.	w.v.d.c.	price	2 for	Cat. #
20,000	MFD 25v.	$ .95	$1.50	S-7120
25,000	MFD 25v.	1.25	2.00	7121
20,000	MFD 30v.	1.25	2.00	7122
40,000	MFD 10v.	.95	1.50	7123
40,000	MFD 30v.	1.75	3.00	7124
8,000	MFD 55v.	.95	1.50	7125

SPECIAL KITS
SK-3
1 SA Tube Replacement
10 600V lamp. Silicon Diodes PRICE: $4.75

MICRO-SWITCH KIT
SK-6
6 Micro Switches 99c
SK-21
20 Sil. Diodes 100 P.I.V. @ 1 amp. 99c

SPECIAL MODULE LITE-UP BOARDS
Contains 30 neon bulbs. Lites up by applying 115V-60 cy. with 30—100K resistors, one for each bulb. Can be used for readouts and making computers, and freq. counters, etc. PRICE: 99c ea. or 3/$2.50

REGULATED POWER SUPPLY

Wickes Model PS—3. Power Input 105-125V, 50-60cps 370 Watts. Regulated D.C. output (adjustable) 270-300V. Max. output current—400ma regulation: 100 to 400 ma—less than 0.5 volt. A C ripple, peak to peak—less than 0.015 volt. Output impedance—less than 0.7 ohm. Overall Dimensions + 19"W x 10½"H x 12⅜"D. Recessed rack mounting. Shpg. Wt., 85 lbs.
Cat. No. S-6425 $34.95

ALL ITEMS FOB OUR WAREHOUSE,
PHILA. PA. — MINIMUM ORDER $3.00

SELECTRONICS
1206 S. Napa St. Phila. 46, Pa. HO-8 4645

W2NSD/1 from p. 3.

should all give the League a rousing cheer (Bronx) for coming up with such a winner. If they do as well for us with the FCC we can turn to stamp collecting.

Good Old Oscar

Along early in March I began to suspect that they really might get that overgrown shoebox into orbit. I think they really hit home when the Oscar III crowd answered my request for launch data or perhaps a collect phone call with a particularly evasive letter, telling me to listen to W1AW like everyone else. Judging from the almost complete lack of public press coverage the committee for Oscar III must have given the rest of the press the same brush-off I got.

So here we are with an operating amateur radio satellite. This should be one of the biggest news stories yet . . . and through unbelievable negligence the story has not been told. This is another clear indication of the immediate need for a change of leadership at ARRL HQ. ARRL Director Howard Shepard was in charge of Oscar III. To date . . . some three weeks after the launching, I have not had one single news release from ARRL, or the Oscar III Committee. Great, eh? I'll leave it to you to project this adept handling of key amateur radio publicity into the international amateur situation.

When I realized that O3 might be up at any minute I called Cushcraft and got them to stop making Squalos for a few minutes and whip up a 22 element Multi-Polarized Twist antenna for me. It arrived a couple days later and my first inclination was to put it up on 73 Mountain on my 120 foot tower. Then I got to brooding about hearing Europe and the ridge to the east which would probably block such goings-on. The result of this was that we installed it at the Hq shack in Peterborough.

O3 went up on the 9th of March and my antenna went up on the 13th. This is about par for me. While Dave WA1DUN and Barry K2YDD/1 were getting the antenna up, Paul WA1CCH and I turned our attention to the rest of the gear. The receiver was easy . . . a converter into my NC-300. The transmitter was more of a problem. A new 826 got my Gonset 2M linear working again (those darned tubes cost over $4 now . . . and they used to sell for 30c!) . . . I also siliconized the power supply so I wouldn't have to worry about 5U4's any more. Four of Meshna's bargain 1000 PIV units worked fine.

I suspected that the 100 watts suggested by O3 Committee was a bit dreamy so I started modernizing an old 500 watt 2M rig (from the W2BFD auction). Silicons in the power supplies . . . tracing out the control circuits . . . new meter panel . . . etc. After only minor catastrophies Paul and I had it perking just fine. One thing I could never understand is why those 4-125A's have to have about 50 watts of drive to work right when the Eimac data sheets call for about one tenth of that. I've never known anyone to get away with the rated input to the grids. I checked with the local FM servicing people and find that they do the same as I do . . . 50 watts drive.

So there we were . . . antenna up and ready to aim . . . converter dishing out beaucoup hiss . . . transmitter ready to grunt out gobs of rf. A short check of the band and I had all the data on the next few orbits from W1JZD. The first orbit was supposed to be very low to the east . . . great for hearing Europe. I didn't even hear the hi signals. On the next orbit, an hour and a half later, the hi's came in quite well and I heard a couple of relayed hams signals fade in and out . . . nothing I could copy. This was going to be harder than I expected. I tried horizontal polarization . . . vertical . . . right hand circular . . . left hand circular . . . horizontal and vertical together . . . all worked about the same . . . I think. I really couldn't tell much because the darned thing was fading in and out and I had to try to keep the antenna following it too. It suddenly became quite clear to me that I needed a lot more sophistication in equipment before I was going to do any serious O3 communications.

In the two weeks since that great discovery I have listened to many of the passes of the satellite and have managed to copy quite a list of calls . . . I've heard a few fellows managing two way copy . . . but very few. I hear Sam W1BU up here on a direct basis, though I've never heard his signal come through O3, and he seems to hear Oscar a couple of minutes before and after I do. I understand that he has had contacts with Germany and Switzerland. Some of the signals peak up to an S6 here, but most are S2 or worse. The most often heard are W8YIO, K2GUG and W8KAY. I have yet to send a dot.

Advertising

If 73 is just another ham magazine to you please skip over this part of the editorial. If you are interested in what I am trying to accomplish then lend me your eyes for a couple minutes.

A digression is obviously called for here. What *am* I trying to accomplish? Basically I

COME TO THE HAMFEST

SUNDAY JULY 4 — PETERBOROUGH, N.H.

73 is having a hamfest. It's going to be a real old fashioned hamfest with fun for all. There'll be no admission charge, no "donation" and no registration fee. Come away from the hot, muggy city to the beautiful Monadnock Region of New Ham Shire to meet us and have a pleasant day with all of your ham friends and all of the activities you enjoy:

Tremendous auction: clean out all of that useless old junk. There'll be no charge and no commission. A special feature will be part of W2NSD's legendary collection for sale.

Antenna measuring contest: Prove that you can make (or buy . . .) a better antenna than everybody else. Find the true gain of your beam. Any horizontally polarized antenna for 2 or 432 that one person can hold is eligible. Have 10 feet of RG58 with a male BNC connector attached for the lead. Prizes and glory for the winner.

Homebrew contest: Bring that gear you've built and show it off. Separate judging for simple and complex equipment, gear built from 73 articles, and on neatness, originality, performance, etc. Prizes.

Two meter hidden transmitter hunt. A contest that belongs at every hamfest. Prizes for the winners.

Dealers: Surplus and other dealers with goodies for sale.

Technical talks and demonstrations by well-known hams and manufacturers.

Special bookshop sale. Unbelievable 73 subscription price. Back issue grab-bag.

73 Mountain and Pack Monadnock for fascinating VHF operation. Bring your portable and mobile gear. Open house at 73.

For the wife and kids: Nearby state parks and mountains with swimming and climbing. Antique shops. Beautiful scenery and pleasant driving. Have a picnic. Bring your food or buy some at nearby shops.

Let us know if you are coming so we can plan accordingly:

73, Peterborough, N. H.

Write to the Monadnock Region Association in Peterborough for information on inns, motels, parks, covered bridges, antique shops, tourist attractions, etc.

10 A.M. Sunday, July 4th at the National Guard Armory three blocks west of the junction of routes 101 and 202 in Peterborough, N. H.

Y'all come.

want to make amateur radio as much fun for everyone as I can. This seems to me to include my attempts at holding down the dictatorial behavior of certain ARRL officials . . . the formation of the Institute of Amateur Radio, and the inclusion of as much technical and construction material in 73 as possible Sure, I botch things up now and then . . . and you have to suffer along with exposures of ego, but for the most part I think we are doing what we set out to do.

The medium for all this is 73 . . . without it you are back to the few articles published in QST and CQ every month and *no* one to speak up when something rotten is perpetrated.

73 is paid for by the advertisers. Your subscriptions pay for us to mail you your copies and provide the readership which encourages the advertisers to advertise . . . but the magazine is paid for entirely by advertising. This means quite simply that the more advertisers we have the more magazine we can publish.

No doubt you've noticed that several of the larger manufacturers are not advertising in 73. There are several reasons for this. A few of the companies count their advertising results by the number of catalogs requested . . . and 73 comes out very poor on this because over 90% of our readers already have most of the

URGENT, NEED IMMEDIATELY

Very high prices paid. Freight prepaid. AN/GRC; PRC; APR; APN; ARC; ALT; URM; UPM; TS. We also buy all military and commercial test, radar, and communication equipment.

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COMMUNICATION CRYSTALS
AMERICAN CRYSTAL CO.
PO BOX 2366 KANSAS CITY, MO.

Ballantine 300 Voltmeter	$49.50
Hewlett Packard 500B Freq. Meter, 3cps-100kc,	$125.00
H.P. 616A UHF Sig. Gen. 1800mc-4000mc.	$475.00
H.P. 475B Tunable Bolometer Mount 1 kmc-4 kmc.	$39.50
H.P. 335B FM Monitor	$275.00
H.P. 415A S W Indicator	$65.00
General Radio 667A Inductance Bridge	$135.00
G.R. 650A Impedance Bridge	$95.00
G.R. 805C Sig. Gen. 16kc to 50 mc. 7 Bands	$450.00
Fairbanks Morse 400cps Generators, 600cps in, 4KVA	$150.00
Microline (Sperry) Model 444 Klystron Signal Source	$175.00
PRD 650 Power Meter	$95.00
PRD 801A Klystron Power Supply	$195.00

Government Warehouse, Inc.
264 Shrewsbury Ave., Red Bank, N. J.

BARGAIN BUYS IN LIMITED QUANTITY SPECIALS!

TEKTRONIC-517 SCOPE	Checked out. Like new	$475.00
TS-175/U FREQ METER	85 to 1000 mc/s Checked out	129.00
BC-221 FREQ METER	125 to 20,000 kc Checked out	75.00
TS-34A/AP Scope	Checked out	49.00
TDQ XMITTER	115 to 156 mc 45 watts Checked out	129.00
RBL RECEIVER	15 to 600kc. Checked out	69.00
RAO Receiver	540 to 30,000 kc Checked out	89.00
BC-342	1.5 to 18 mc 6 bands Checked out	79.00
BC-348	200 to 500 kc & 1.5 to 18 mc Checked out	89.00

HEADSETS:		
	HS-23 2000 ohms	$4.95
	HS-33 600 ohms	5.95
	Hi-Fi Headset 600 ohms	9.95

Money Back Guarantee on Everything We Sell.
Write for free bargain flyer.
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TRANSTENNA 102A

A PRESELECTOR SECOND TO NONE AND A T-R SWITCH BEYOND COMPARISON

Pat. Pndg. U.S.A. & Canada

MODEL 102A

$69.45 (Add $7 for Sidetone — either model)

15 DAY TRIAL

Return For Full Refund If You Burn It Out Or Are Not *FULLY PLEASED*

- Std. coax coupler (xmtr to feedline)
- Monitored switching
- No TVI or Suck out
- Full Legal Input
- 30 DB Min. Gain (10-80 mtrs)
- Burnout Proof
- No Effect on Transmission
- CW Sidetone (optional)

Write for Free Literature

Improved 102A Adjustable Mute Circuit Breaks Any Xmtr-Rcvr Between Dots & Dashes Without Clicks. Improved Semiconductor Through-Position Switch Switches Rcvr Directly to Antenna for Unity Gain 6-80 Mtrs.

102B, $59.00 like 102A exc. rcvr. muting

FICHTER ELECTRONICS — 33 Myrtle Avenue, Cedar Grove, N. J. Tel: CEnter 9-6412

SURPLUS BARGAINS

We have moved to new quarters to start the new year with. Lucky finds and scarce items.

TCS DYNAMOTOR MOBILE POWER SUPPLY
NEW 12 v dc input, 400 v dc @ 200 ma output.
$3.95 postpaid west of Denver. $4.95 postpaid east

Dow Trading Company
N. Dowdell W6LR — **2057 E. Huntington**
Elliott 7-3981 — **Duarte, California**

SG98/URM75 4-220mc Signal & Sweep Generator. Crystal Calibrator & Modualtion. Manuals. For 60 cy.	EX	67.75
Polarad LTU-3A Tune. Unit 4460-16520 megacycles.	EX	$355
Ferris 32-B RF Noise and Field Strength Meter	EX	$195
Tektronix 121 Wide Band Preamp for 511 Scope	EX	47.75
Gen. Radio 667A Induct. Bridge .1 microhenry-1H	EX	$155
Rollins Mod. 80 Hi Level Sig. Gen. 2.7-3kmc @ 10W	EX	$475
Ballantine 300 AC VTVM in 19" rack panel	EX	38.50
Lambda 28 200-325VDC @ 100ma 1% Reg. 6.3VAC	EX	22.50
Lambda 32 200-325VDC @ 300ma 1% Reg. 2X6.3VAC	EX	31.75
T61/AXT2 TV Xmtr W/Video 7 Sync Modulators	NEW	17.50
RT62/APX6 Converts to 1215-1236 mc X'celver	NEW	21.75
UPM8 Tests APX6. 27 Tubes, 16 Diodes. For 60 cy.	GD	14.50
Manual for TS726/UPM8 above. Postpaid	NEW	2.00
SWR Bridge Micromatch-Reflectometer. 30-1000mc.	EX	8.25
R23/ARC5 The "Q5-er" tunable IF. 190-550kc.	GOOD	11.25
RT18/ARC1 100-156mc Xceiver. W/Tubes & DY9	GOOD	19.75
Same less tubes and Dynamotor DY-9	GOOD	9.75
T465/ALT7 Xmittr 168-332mc W/2-616ls. 100W out.	EX	22.50
Schematic for T465/ALT7 with parts values.		1.00
Tube Type 616 W/connectors. Good to 2000 mc	EX	7.50
SA325/U Coaxial Relay 8P4T. With 28 VDC Motor	EX	3.25
Set of 120 Xtals Type FT243 5675 thru 8650kc		120/17.50
CU119A Coupler 13 one-tube amplifiers w/tubes	NEW	4.75
CU48/ARA6 50 ohm coax to twin-line coupler	NEW	3/5.00
RE2/ARC5 Ant. Relay W/Meter & Vac. Capacitor	EX	3/6.00
Meter Weston Model 843 500-0-500 microamps. 3"	EX	3.85
APN1 Xceiver 420mc. Less modulator and Tubes	GOOD	3.75
IC/VRW7 Wire Recorder 28 VDC W/Tubes	GOOD	4.75
R122A/ARN12 75 mc Superhet. W/9 Tubes & Xtal.	GD	2/7.00
Rt. Angle Drive W/Gears & Universal. ¼" shaft	EX	3/5.00
UPM11A AFC Unit W/8 Tubes & Wiring Diagram	NEW	3.75
AN/APR9 Microwave Test Set for APR9 Receiver	LN	$650

E. C. HAYDEN — **BOX 294 Bay Saint Louis Mississippi**

Shipment: FOB Bay Saint Louis. — **Terms: Net, Cash.**

catalogs. I've been trying to interest them in selling their products rather than catalogs in the ads, but haven't done too well with this novel approach as yet.

That still leaves quite a number of major firms who are not advertising in 73 and I don't know for sure why they aren't. I do know that those companies who are advertising claim very good results. Some claim astounding results. Perhaps you can do something to help us in this matter.

If you mention 73 when you write for information to companies that are not advertising in 73 . . . ask them about it at conventions . . . ask their distributors . . . their manufacturers representatives. Let them know which magazine you want them to support . . . which one will get to *you*, their prospective customer. Let's see if we can get any one of the advertisers in the first pages of QST to support 73 . . . now *there's* a challenge for you.

There really aren't many logical reasons for not advertising in 73. Our rates are a lot lower than the other two magazines, one of which seems to have considerably less circulation than 73. Our results for most advertisers have been outstanding. How about a job as Assistant Advertising Manager?

Help! He Says . . .

Several readers have forwarded a letter to them by the Midwest ARRL Director. It makes morbid reading. "Frankly speaking, our amateur bands are going to be in more danger at the next international allocations conference than at any time in my memory." Then he goes on, frequently saying, ". . . the League's efforts to save amateur radio as we know it . . . to help save amateur radio . . . to help save the amateur bands . . . to help save amateur radio. . ." Then, "The ARRL has saved amateur radio on several occasions in the past . . . the ARRL can save it again with your help."

The ARRL has not, during the 27 years I've been a member, saved amateur radio from anything. Sure, Percy Maxim saved ham radio back after WWI, almost 50 years ago . . . but that wasn't any ARRL that I am familiar with and it seems to me that if that is the saving job they have been using on us all these years that it is just a little thin by now.

The most interesting thing to me is that an ARRL Director is writing exactly the same things that I have been criticized by the League paid management for writing . . . that we face a very threatening future. I doubt if anyone in the history of the League has ever been so personally maligned in QST editorials as I was for saying just that.

GENERAL RADIO

VARIAC 26 amp max output model V-20, 115 volts AC 60 cycle in. 0-135 volts out. These are brand new surplus w/knob & plate. Priced about ½ cost.

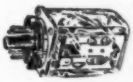
$24.00

88 MH TOROIDS. Two types available. Open and potted. Used for many applications such as power supplies and teletype.

Open style **50c** each, **12/$5.00**
Potted style **65c** each, **12/$6.00**

SIGMA Relays 115 volt, 60 cycle, 2 amp contacts SPDT.

75c ea. 8 for $5.00

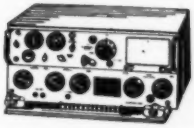


SIGMA: DPDT, 5 amp contacts, operation 1.5 volt dc or 12 v ac. DPDT Enclosed, plug-in **$1.00 ea.**
6 for $5.00

11/16" TELETYPE PUNCH TAPE Buy 2, save on shipping. **SPECIAL:** 6 cartons **$25.00** Carton 40 Rolls **$5.00**

AN/ART-13 100-WATT XMTR
11 CHANNELS
200-1500 Kc
2 to 18.1 Mc

$39



Collins Autotune Transmitter, extremely stable and suited for side band. Written up in QST Oct. issue 1953. Used, with tubes.

CQ's NEW Conversion Book **$3.00.** Pages of surplus Conversions plus 3 articles on ART-13.

Meshna's new Winter catalog now ready. Send 20c for yours before they are all gone.

MESHNA

19 ALLERTON ST., LYNN, MASS.

All Material F.O.B. Lynn, Mass.

If enough Directors come to understand what we are facing they may possibly be able to communicate a sense of urgency to their paid management and get them to stop the deluge of actions which are so seriously hurting amateur radio. If they could but heal the deep wounds in IARU this would be a major step forward.

Executive Opening

The Institute of Amateur Radio, Inc., is looking for a full time Secretary to work at the 73 headquarters in New Hampshire and coordinate the activities of the Institute. He will be in charge of preparing mailings for Congress to keep our Senators and Representatives aware of the activities and value of amateur radio. He will investigate legal cases being fought by amateurs and help them with information and administer grants by the Institute to help fight important legal battles. He will work to implement the wishes of the Directors of the Institute. He will work to keep the membership informed through newsletters and the pages of 73.

This is one of the most important jobs in amateur radio today and the effectiveness of the man who takes on this job may have more influence on the future of our hobby than any

Rectifiers & Transistors

750 ma Silicon diodes "Epoxy" or "Top Hat"

PIV		PIV	
50	5c	600	21c
100	7c	*700	25c
200	10c	*800	32c
400	14c	*900	40c
500	18c	*Top Hat only	

Silicon Power Diode Studs 3 amps

PIV		PIV	
25	6c	300	25c
50	8c	400	28c
100	14c	500	35c
150	16c	600	40c
200	22c	All Tests	

Full Leads, Tested, Guaranteed, American made

10 Watt Sil. Zener studs, 6-150v, any voltage ..... 95c ea.
1 Watt Zener Diode Axial leads 6v-200v ..... 50c ea.
Sil. diode stud 1500 PIV 300ma ..... 50c ea.
12 Amp Stud Sil. Rect. 100 PIV ..... 75c ea.
Hi-Voltage-Silicon epoxy diode, 2½" x ⅜" x ½". .....
Hoffman—3000 PIV-200ma. ..... $1.49 ea.
Hoffman—6000 PIV-200ma. ..... $3.49 ea.
Thermistor, glass bead, 1200 ohms, 600°F, ... 2/$1.00
Sil. Power 2N174—$1.95; 85 watts Transistor

20 Watt Germanium (Internal Heat Sink)

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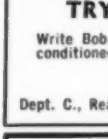

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other single person. This position should pay $20,000 a year or more . . . no question about it. We are penny wise and pound foolish to try to put a boy in this man's job. But the Institute does not have backing of this magnitude at present so some compromise will have to be made. I suggest that this is an ideal job for a mature ham . . . one with good business background . . . possibly someone who is retired and doesn't need the higher income we don't have as yet. The Interim Directors of the Institute have agreed on a starting salary of $5000 a year, a sum which does enable one to live quite comfortably up here in economical New Hampshire.

If you are interested in working for the good of amateur radio . . . if you have the background to get this job done and done well . . . if you are free to move up here . . . please send a resume to the Institute of Amateur Radio, Peterborough, New Hampshire.

Institute Wins

The other night I got a call from Mace Warner WØJRQ of Denver. He was just back from court and wanted everyone to know that he won his case . . . a case that, if lost, could have had serious repercussions for all of us. At the instigation of a neighbor, Mace was being sued for $8000 because his tower and antenna were unsightly and devalued nearby properties. It should be mentioned that Mace lived there and had his antenna up before the suers moved into the neighborhood. There was no TVI involved in the case.

Mace was about at the end of his string, having spent close to $2000 on attorney fees and costs, when the Institute of Amateur Radio came to his aid and provided $500 which permitted him to carry the battle into the next court where he won the case. Mace said that he had given up hope and had about spent himself out when the Institute came along and gave him the incentive and backing to fight.

This is a real victory for ham radio . . . and a fine example of what the Institute can accomplish. How many of us are prepared to spend thousands of dollars to prevent a dangerous precedent from being set that could sweep hundreds of hams into trouble all over the country if lost? Battles like this should be fought with group funds . . . we all should pitch in to help in these fights which affect all of us. Only the Institute is carrying on this fight . . . have you joined yet?

Many amateurs are a bit hazy about amateur legal problems and believe that the League is active in supporting amateurs who

are fighting precedent cases. This is not true. The ARRL will on occasion provide legal advise to the lawyer that is on the case, but they will never and have never to my knowledge given one cent to help out the amateur that is in trouble. The Institute and *only* the Institute is sending cash money to help these court battles.

Calling Frequencies

Those of you who are on wide band FM or are thinking of it should give serious consideration to setting up on one national channel. FM nets have sprung up on a good many frequencies around the country . . . which makes it difficult fol fellows who are travelling around. Why not make the change this spring to one standard calling frequency on each band? The most popular ones are 52.525 and 146.94 mc. If your nets are not on these channels why not send out for crystals now and get set up with everyone else. In this way visitors will be able to call in while nearby and you will be able to talk to FM'ers in other areas when you're driving around the country.

Need a New One?

If you happen to be prefix hunting you might look for 4U-ITU with numbers 1-6 being used in rotation so that one station can give you six prefixes on May 16-17. Frequencies will be 1810, 1830, 3503, 3797, 7003, 7045, 14113, 14292, 21050, 21400, 28050, 28625, kc and 145.1 mc. It is just possible that you may hear me operating from there if I can make it and if they'll let me in.

Reciprocation

The FCC called the other day to let me know that reciprocal agreements have been completed with Bolivia, Costa Rica and the Dominican Republic so far. They ask that aliens please not apply for permission to operate until an agreement has been signed with their country. Many more are in the works, I know . . . about 35, I believe.

Little Trip

During May I will be visiting Europe. If you know any hams over there that I should visit you might drop me a line with their address. I intend to say hello to as many VHF amateurs as possible as well as officials of the radio societies. My trip will start at Frankfort and go to Stuttgart, Zurich, Geneva, Milano, Trieste, Zagreb, Budapest, Wein, Praha, Nuremberg, Hanover and Hamburg. I'll try to be on from 4U1ITU during their May 16-17th party.

. . . Wayne

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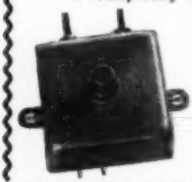

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7TH ANNUAL PENN-YORK HAMFEST. Morrison's Restaurant, Big Flats, N. Y. (Between Elmira and Corning, N. Y.) June 19th, 12 noon. Grand award NCX-3 SSB Transceiver. Preregistration $4.50-$6.00 at door. Send SASE to Earl J. Foster W3BKF, Chairman, RD #2, Gillett, Pa. Last day for pre-reg June 12th. Speakers, swapfest, contests, etc. Smorgasbord dinner, all you can eat. Only 600 tickets available.

KISHWAUKEE RADIO CLUB SWAPFEST Sunday, May 2 at DeKalb, Illinois. Contact Alton L. Brand, 415 E. Sycamore St., Sycamore, Ill.

FT-243 CRYSTALS: $1 each for 2 kc accuracy, $2 for 0.01%. Air mail 10c extra each. Denver Crystals, 776 South Corona, Denver, Colorado 80209.

TRI-STATE ARA annual picnic. Camden Park, US 60 West, Huntington, West Virginia. 12 noon to 6 on Sunday June 6th. Displays, surplus, swap. Contact W8VA at 2937 Auburn Road, Huntington, W. Va.

FRESNO ARC HAMFEST. Saturday May 15. More information from Carl Massie WA6ZVY, P. O. Box 783, Fresno, California.

MISSISSIPPI VALLEY HAMFEST sponsored by the Quad City ARC at the Indian Bluff Forest Preserve near Milan, Ill. Wide variety of activities for hams and their families. Starts at 9 AM. For more information write W. M. Coopman K9CHZ, 911-23rd Ave., Moline, Ill.

HAM AUCTION, May 3. Check gear in at 6 pm, auction at 8. River Park ARC, 5100 North Francisco Avenue, Chicago, Ill.

BIRMINGHAMFEST. Sunday, May 1st and 2nd. More dope from Mike Thomason K4FQF, Box 603, Birmingham, Ala.

EASTERN WISCONSIN HAMFEST. Sponsored by the Ozaukee RC on May 15, Get more information from Harvey Goldberg, Box 13, Port Washington, Wisconsin.

SWAP FIESTA. Sponsored by the El Paso ARC. May 15 and 16 at the Mall of Bassett Center in El Paso. More information from Hurley Saxon K5QVH, 1501 Golden Hill Terrace, El Paso, Texas.

MOULTRIE ARK Hamfest. Sunday, April 25. Lynn Cunningham, 904 West Jackson, Sullivan, Illinois.

FREE! BLUE BOOK LIST. Leo offers hundreds of bargains on reconditioned gear. Viking II $97.70; NC300 $189.00; Collins 62S-1 $625.50; King 500A $259.00; SP600 $296.65; Heath MRI $59.46; DX-40 $40.50; Cheyenne $49.18; SX-140 $72.15; SX-101 $160.65; HQ140XA $134.10. Many more. Also, free 1965 catalog. WØGFQ, WRL, Box 919, Council Bluffs, Iowa.

RCA VTVM WV77E $20. Simpson #215 VOM $12. RCA audio generator 30-15000 cy. $15. ART-13 $25. FOB W6IIA, Jack Tate, 425 Tufts Avenue, Burbank, California. 91504.

HT-44 and matching PS-120/150. Like new. Original cartons, manual. 200 watts SSB, CW AM. Asking $375. Gray W2EUQ, Painted Post, N. Y.

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DRAKE 2B-AQ speaker like new, $205. BC-453 Q5'er, New $18.95. New transmitters BC458A, $8.95. BC459A, $12.95. New 829B's $7.95. FOB W9KAJ, Box 55A, Rt. 2, Delavan, Wisc.

CLEANING SHACK. Low and medium power VHF transistors (other types also) at low prices. Send for list. Jack Pritchard, 4336 Livingston, Dallas, Texas, 75205.

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CASH, SONY TRANSISTOR TV's etc., swapped for G-R, H-P, L&N etc. laboratory equipment, special tubes, manuals, military electronics. ENGINEERING ASSOCIATES, 438 Patterson Road, Dayton, Ohio 45419.

COLLINS KWM-2, 516EL & PM-2 Power Supplies, Mosley automatic 5 band mobile antenna TM-5, portable Tote-Tenna & case. New cost $1,847. Will sell for $1,200. All in excellent condition. Call Manchester, N. H. evening 472-3641 or address W1ACC P. O. Box 808, 1217 Elm St., Manchester, N. H.

NCX-3 with NCX-A, used only few months, perfect condition, $300. Heath Sixer and Twoer, 4 xtals with each, both $65. New B&K Dynamatic 375 VTVM, warranty card, cost $90, sell $55. All with original accessories and manuals. W3PQK, 615 Market St., South Williamsport, Pa. 17707.

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MODEL 28 KSR TELETYPE—Mint Condition. John R. Niehaus, 208½ Church Street, Doylestown, Ohio 44230.

SIXTH ANNUAL GREENVILLE HAMFEST will be held Sunday May 2, 1965, at the Greenville County Fairgrounds, Greenville, S. C. Complete program for the family. Plenty of shelter space in case of bad weather. Lunch included in admission price. Information from Don Robertson, WA4KLT, 101 Grin Drive, Greenville, S. C. Sponsored by the Blue Ridge Radio Society.

TOROIDS, uncased, removed from space age surplus. 1.0 Hy .83 Hy .25 Hy 50c ea. Lock City Electronics R1, Sault Ste Marie, Michigan.

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RANGER ONE $75. Ranger Two $175. Bill Witsman, K9TMA 23W511 Bryn Mawr Ave., Roselle, Illinois.

ANTENNAS! Mosley TA-33, $45.00; Hy-gain 12AVS, roof mount, extra traps, $18.00; Saturn Six halo with bumper mount, $10.00; Albert Johnson K1IIK, Pinnacle Road, Newport, N. H.

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Ask for what you need. We will then send you COMPREHENSIVE DATA on what we have to meet your needs. DON'T ask for a catalog . . . it would take a fat book . . . and then it would give you less details about the thing you are interested in than we will give you in answer to your letter. Be as specific as possible as to frequency, power needed, etc.

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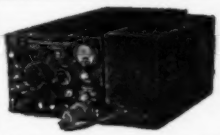

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AC PWR for SCR-522: RA-62-B made by Signal Corps for the specific job! 115/230v, 40 60 cy in. Regul. & filt. outputs 300v, .28A: 13v, 4A: -150v. 10 ma. OK grtd, w/data, 90 lbs. fob Sacramento **29.95**

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ARC-1 Transceiver. 100-156 mc with tubes. Less dynamotor. Good used. Special. FOB $19.00

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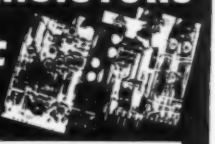

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KILOWATT SSB station with complete antenna syste[illegible] Station includes Heath SB-300, SB-400, SB-200, HM-1[illegible], HO-13, Astatic D-104C. Write for details. W9FMW, 1567 Southfield Road, Evansville, Indiana.

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Silicon PNP/TO5 & TO18 25c @, 5 for $1
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1	.08	.14	.17	.24
12	.60	.85	.70	.85
18*	.20	.80	.50	.75
35	.70	1.00	1.50	2.00
100	1.65	2.05	2.50	3.15
240	3.75	4.75	5.75	6.75
DC AMP	**300Piv 210Rms**	**400Piv 280Rms**	**500Piv 350Rms**	**600Piv 420Rms**
1	.29	.30	.40	.48
12	1.00	1.35	1.45	1.70
18*	1.00	1.50	Query	Query
35	2.15	2.45	2.75	3.85
100	3.75	4.00	5.50	8.00
240	11.70	17.10	23.94	29.70

*P.F. PRESS-FIT AUTOMOTIVE TYPE!

18 Amp Press Fit up to 200Piv 4/$1
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Piv/Rms	Piv/Rms	Piv/Rms	Piv/Rms
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.05	.09	.12	.14
Piv/Rms	**Piv/Rms**	**Piv/Rms**	**Piv/Rms**
400/280	500/350	600/420	700/490
.18	.19	.25	.27
Piv/Rms	**Piv/Rms**	**Piv/Rms**	**Piv/Rms**
800/560	900/630	1000/700	1100/770
.35	.45	.65	.75

GTD ALL TESTS AC/DC & LOAD!

1700 Piv/1200 Rms/750 Ma/$1.20 @, 10/$10
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12 KV/8400 Rms/200 Ma $8 @, 2/$14

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PRV	7A	16A	PRV	7A	16A
25	.60	1.00	200	2.70	3.00
50	1.00	1.35	300	3.00	3.45
100	1.60	2.15	400	3.75	3.90
150	1.95	2.45	500	4.75	4.80
200	2.20	2.80	600	5.45	5.65

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Glass Diodes IN34, 48, 60, 64, 20 for $1

Two RCA 2N408 & Two Regulators RCA IN2326 on prtd ckt. 30c @, 4/$1

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4-400A	25.00	829B	7.20
4-1000A	75.00	872A	3.50
		OA2	.65
OB2	.55		
5R4WGA	3.50		
24G	Query		

We Swap Tubes! What Do/U Have?

OA3	.80	5R4	1.00	6F7	.99
OC3	.70	5T4	.90	6F8	1.39
OD3	.59	5V4	.89	6H6	.59
OZ4	.79	5Z3	.89	6J5	.59
IL4	.82	6A7	1.00	6J6	.59
IR4	5/$1	6A8	.99	6K6	.59
IS4	.78	6AB4	.59	6L6	1.19
IS5	.68	6AC7	.72	6SN7	.72

Send 25c for Catalog!

IT4	.85	6AQ5	.65	6V6GT	.90
IT5	.95	6AG7	.75	12AU7	.69
IU4	6/$1	6AK5	.69	12A6	.45
IU5	.75	6AL5	.55	25L6	.72
2C39A	Q	6AQ5	.66	25T	4.00
2C40	5.50	6AR6	1.95	26D7	.89
2C43	6.50	6AS7	3.49	50L6	.59
2C51	2.00	6AT6	2/$1	83V	.95

We Buy!		We Sell!		We Trade!	
2D21	.65	6BA6	.59	250TL	19.45
2K25	9.75	6BE6	.59	VR92	5/$1
2K28	30.00	6BK7	.99	388A	2/$1
2V3	2/$1	6BQ6	1.19	416B	16.00
2X2	.48	6BY5	1.19	450TL	43.00
4X250B	30.00	6BZ6	.91	813	9.95
5BP4	7.95	6C4	.45	815	1.75

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"VOLT-TAB" 600Watt Speed Control 115VAC $4.50 @, 2 for $8

866A Xfmr 2.5V/10A/10Kv/Insl $3 @
Ballentine ±300 AC/Lab Mtr. $54
(Sd) Choke 4Hy/0.5A/27Ω $40 @, 2/$6
"VARIACS" L/N 0-135v/7.5A $15
"VARIACS" L/N 0-135v/8A $10
TWO 866A's & Fil. Xfmr. $8

SILICON TUBE REPLACEMENTS

OZ4	UNIVERSAL $1.75 @, 2/$3
5U4	1120Rms/1600Inv $2 @, 3/$5
5R4	1900Rms/2800Inv $9 @, 2/$15
866	5Kv/Rms - 10.4Kv Inv $11 @, 2/$20

Mica Condsr .006 @ 2500V 4/$1
Saucerscope Tube 2" $5 @, 2/$8
Mini-Fan 6 or 12Vac/60Cys $2 @, 3/$5
4X150 Ceramic Loktal $1.25 @, 2/$2
Line Filter
Line Filter 50Amp/250VAC $10 @, 2/$16

DC 3½"/Meter/RD/800Ma $4 @, 2/$7
DC 2½" Meter/RD/100Ma $3 @
DC 2½" Meter/RD/30VDC $3 @, 2/$5
AC 3½" Meter/RD/130VDC $5 @, 2/$9
DC 4" Meter/RD/1Ma/$5 @, 2/$9

Battery Charger 6&12V Charges up to 5Amp "Approved" Heavy Duty Design with Klixon Circuit Breaker. Operates 220 or 110VAC @ 50 or 60 Cys $8, 2 for $15, 7/$49

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400VDC Supply @ 200MA & Silicon Rect & Filters $10
20VAC & TAPS/.8,12,16, 20V @ 4A, $3
32VCT/1A or 2X16V @ 1A, $8 @, $2/$5

Line Filter 4.5A @ 115VAC 4 for $1
Line Filter 5A @ 125VAC 2 for $1
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2.5MH PiWound Choke/National 5 for $1

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Kit 10 Mica Sorted Cond's.
Kit 10 Transmit Mica Cond's.
Kit 8 Phone/Patch Xfmrs
Kit 10 Inslid Tuning Tools
Kit 10 Sub-Min Tubes
Kit 10 Spkr Clips Asstd
Kit (6) Tube Sockets Asstd
Kit (82) Transistors PNP & NPN
Kit (12) 2Amp Stud Rectifiers
Kit 75 Mica Condensers
Kit 10 Crystal Diodes
Kit 200ft Hook Up Wire
Kit 4 Rolls, 500ft/ea. Assorted Color
Kit 5 FT243 Xtal Holders
Kit 10 Xtal Osc. Blanks
Kit 10 Asstd Rectifiers
Kit 100 Asstd Resistors Cut
Kit Adj Wire Strippers & Cut
Kit HI Gain Xtal Mike
Kit 2 pair SO239 & PL59
Kit 12 Binding Posts Asstd
Kit (3) TO36/50Watt Untested
Kit (10) TO5/1WAT 5/A/Diodes Untested
Kit (10) TO18/1WAT 5/A/Diodes Untested
Kit (4) PF/PressFit 15Amp Studs
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6.3VCT @ 15.5A & 6.3VCT @ 2A $4 @, 2/$6
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Printed Ckt Bd New Blank 9x12" $1 @, 6/$5
Klixon 5A Reset Ckt Breaker $1 @, 8/$5
2K to 8K Headsets Good Used $3 @, 2/$5
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Bandswitch Ceramic 500W 2P/6Pos $3 @, 2 for $5
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7-½Hy-400Ma Choke Cased $7 @, 2/$12
250Mfd @ 450 Wv Lectlytic 4/$5B $3 @, 4/$10
Cndsr Oil 10Mfd x 600-2x2.5 & 5Mfd $1 @, 15/$10
Cndsr Oil 6Mfd @ 1500V $4 @, 4/$10
680Vct @ 785Ma for SSB $9 @, 2/$16
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Pwr Sup Kit 1200VDC @ 200Ma/Xfmr & FWB Silicon Rect $10 @, 2 for $18
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Socket Ceramic 866 Tube 4/$1
Socket Ceramic 4X150/Loktal 4/$2

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T30 Throat Mikes $1 @, 4 for $3
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Linear SawTooth Pot KS15188/W. E. 3 for $1

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In addition to considerable discussion on the new FCC proposals, we'll have a big June surplus issue next month and a giant VHF issue in July. Of course you can follow the "party line" in brand X, if you want . . . but we'll have the real stuff here.

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Propagation Chart

May 1965

J. H. Nelson

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7*	7	7	7	7	14	14	14	14	14
ARGENTINA	14	14	14	7*	7	7	14	14	14*	21	21*	21
AUSTRALIA	14	14	14	7#	7#	7	7	7	7	7#	14	14
CANAL ZONE	21	14	7	7	7	7	14	14	14	14	14	21
ENGLAND	14	7	7	7	7	14	14	14	14	14	14	14
HAWAII	14	14	14	7	7	7	7	7#	14	14	14	14
INDIA	7	7#	7#	7#	7#	7#	14	14	14	14	14	7#
JAPAN	14	14	7#	14	7	7#	7#	7*	7	7#	14	14
MEXICO	14	14	7*	7	7	7	14	14	14	14	14	14
PHILIPPINES	14	14	7#	7#	7#	7#	7*	14	14	14	14	14
PUERTO RICO	14	7*	7	7	7	7	14	14	14	14	14	14
SOUTH AFRICA	7#	7	7	7#	7#	14	14	14	14	14	14	7#
U. S. S. R.	7	7	7	7	7	7*	14	14	14	14	14	7*
WEST COAST	14	14	14	7	7	7	7	14	14	14	14	14

CENTRAL UNITED STATES TO:

ALASKA	14	14	14	7	7	7	7	7*	14	14	14	14
ARGENTINA	14	14	14	7*	7	7	14	14	14	14	21*	21*
AUSTRALIA	14	14	14	7#	7	7	7	7	7	7*	14	14
CANAL ZONE	21	14	7*	7	7	7	14	14	14	14	14*	21
ENGLAND	14	7	7	7	7	7	14	14	14	14	14	14
HAWAII	14	14	14	7	7	7	7	7*	14	14	14	14
INDIA	14	14	7#	7#	7#	7#	7#	14	14	14	14	14
JAPAN	14	14	14	7#	7	7#	7#	7*	7	7#	14	14
MEXICO	14	14	7	7	7	7	7	7*	14	14	14	14
PHILIPPINES	14	14	14	7#	7#	7#	7#	7*	14	14	14	14
PUERTO RICO	14	14	7*	7	7	7	14	14	14	14	14	14
SOUTH AFRICA	7#	7	7	7#	7#	14	14	14	14	14	14	7#
U. S. S. R.	7	7	7	7	7	7	7*	14	14	14	14	7*

WESTERN UNITED STATES TO:

ALASKA	14	14	14	14	7	7	7	7	7*	14	14	14
ARGENTINA	14	14	14	14	7	7	7#	14	14	14	21*	21*
AUSTRALIA	21	21*	21	14	14	14	7	7	7	7	14	21
CANAL ZONE	21	14	14	7#	7	7	7#	14	14	14	14*	21
ENGLAND	14	7	7	7	7	7	7	7#	14	14	14	14
HAWAII	21	21*	21	14	14	7	7	7	14	14	14	14
INDIA	14	14	14	14	7#	7#	7#	7#	14	14	14	14
JAPAN	14	14	14	14	7#	7	7	7	7	7	7#	14	14
MEXICO	14	14	7#	7	7	7	7	7	7#	14	14	14
PHILIPPINES	14	14	14	14	14	7#	7	7#	14	14	14	14
PUERTO RICO	14	14	14	7	7	7	7*	14	14	14	14	14
SOUTH AFRICA	7#	7#	7	7#	7#	7#	7#	14	14	14	14	7#
U. S. S. R.	7	7	7	7	7	7	7	7*	14	14	14	7*
EAST COAST	14	14	14	7	7	7	7	14	14	14	14	14

\# Very difficult circuit this hour.
* Next higher frequency may be useful this hour.

Good: 1-9, 12-14, 20-22, 26-29
Fair: 11, 17-18, 23-25
Poor: 10, 15, 16, 19, 30-31
VHF DX: 7, 8, 18, 19, 26

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